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BUREAU OF COMMERCIAL FISHERIES

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	6 Fishery byproducts	

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget November 23, 1956.

0.33 BROWNING REACTION INITIATED BY GAMMA IRRADIATION

Liggett, R. W.; Feagel, C. E.; and Ellenberg, J. Y. (Southern Research Institute, Birmingham, Alabama)
Journal of Agricultural and Food Chemistry 7, 277-280 (April 1959)

This investigation was designed to compare the brown coloration produced in sugars by gamma irradiation with the brown coloration produced by heat. The browning reaction produced by heat may involve the reaction of sugar with amino acids or may be caused by the decomposition of sugar itself. The acid-base catalyzed thermal decomposition of reducing sugars in many cases has been demonstrated to be as important a factor in the nonenzymatic browning of foods as is the more commonly recognized reaction between reducing sugars and amino acids.

The browning reaction in irradiated sugars is important because of the potential use of irradiation for sterilizing foods and pharmaceutical products that contain sugars.

Color is formed in heated sugar solutions by the action of two mechanisms. The first mechanism, which operates in acid media, converts the sugar into furfural derivatives. These colorless compounds decompose to colored polymeric products in dehydration reaction. Thermal destruction of dry sugars also proceeds by dehydration with the formation of oxide rings in the primary products.

The second mechanism involves the fragmentation of the sugar molecules and the formation of reductones and other enediols that condense to colored polymeric products: Enediol formation is an oxidation-reduction reaction.

Experimental procedure.--Reducing sugars, a nonreducing sugar, and two polyhydroxy compounds were used in the present study. For irradiation, the sugars were exposed to a 800-curie cobalt-60

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 ABSTRACTER: Kathryn L. Osterhaug

0.5 THE ACTION OF PSEUDOMONAS ON FISH MUSCLE: 4. RELATION BETWEEN SUBSTRATE COMPOSITION AND THE DEVELOPMENT OF ODORS BY PSEUDOMONAS FRAGI

Castell, C. H. and Greenough, Maxine F. (Fisheries Technological Station, Halifax, Nova Scotia)
Journal of the Fisheries Research Board of Canada 16, 21-31 (January 1959)

Introduction.--The fourth paper in this series is concerned with a group of 20 bacterial cultures that produce distinct fruity and oniony odors on chilled muscle of cod and haddock during early spoilage. These bacteria previously were identified as Pseudomonas fragi by Castell, Greenough, and Dale (1959). The purpose of the work described here was to determine under what conditions these particular odors are produced and from what components of the muscle they arise.

Identification of odors.--The persons who judged odors in this work were experienced and in agreement on the terms to be used in describing each particular type of odor. Odors classified as "fruity" include various ester-like odors suggesting pineapple, May apple, strawberry, and melon. "Oniony" odor includes those suggesting fresh onion or garlic, but more often, sour and spoiling onions. The term "vegetable-like" has been used for a variety of odors suggesting fresh and spoiling turnips, cabbage, and cauliflower. This type of odor frequently develops into a disagreeable sour odor. The development of odors has been observed and followed by enclosing inoculated substrates in screw-capped bottles, which were periodically examined by removing the cap and noting the odors as the mouth of the bottle was held to the nostrils. Experience demonstrated that appropriate intervals of time were needed between smellings.

The characteristic fruity and onion-like odors produced by Pseudomonas fragi are the result of the action of these organisms on substrates containing partially hydrolyzed proteins. The immediate protein derivatives from which the bacteria produce the fruity odors are mono-amino

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 ABSTRACTER: Martin Heerdt

0.5 THE ACTION OF PSEUDOMONAS ON FISH MUSCLE: 3. IDENTIFICATION OF ORGANISMS PRODUCING FRUITY AND ONIONY ODORS

Castell, C. H.; Greenough, Maxine F.; and Dale, Jacqueline (Fisheries Technological Station, Halifax, Nova Scotia)
Journal of the Fisheries Research Board of Canada 16, 13-19 (January 1959)

Introduction.--Castell and Greenough (1957) demonstrated that bacteria capable of producing "sweet" and "fruity" odors can be isolated from fresh and spoiling fillets and that these bacteria belong to the genus Pseudomonas. This paper is a study of a group of 20 cultures of Pseudomonas that have been isolated from Canadian Atlantic fish. These cultures produce distinct fruity and oniony odors when grown as pure cultures on fish muscle. The purpose of this study has been to identify and describe these organisms. Unless otherwise mentioned, the methods used for culturing and identifying these bacteria were either standard procedures or those given in the first paper in this series by Castell and Greenough (1957).

Results in general.--The 20 cultures showed a remarkable uniformity in colony formation, staining reactions, carbohydrate fermentations, and inability to decompose protein and reduce nitrates to nitrites. Variations did occur, however, in their ability to hydrolyze fats and to produce nitrite from hydroxylamine. These cultures appear to be very similar to the Pseudomonas of Hussong et al. (1937), which produced a "sweet, ester-like odor resembling that of the flower of the May apple." Cultures of Pseudomonas fragi isolated from fish fillets differed from the description of cultures of Pseudomonas fragi given in Bergey's manual (1948) in that they did not liquefy gelatin and did produce acid from maltose and, in some cases, from sucrose and glycerol. These differences are relatively unimportant.

Growth and reaction on single sources of carbon.--Fermentation studies using members of the

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 ABSTRACTER: Martin Heerdt

2.118 FACTORY DECK OPERATIONS: THE RUSSIAN WAY

Anonymous
World Fishing 7, 73, 80 (November 1958)

On the latest Russian factory trawlers, there are two filleting lines--one for large cod and the other for medium-sized cod. Scaled fish move along the conveyor into the sorting section, where they are separated into the two sizes. Large fish go to the heading machine, whereas medium-sized cod are loaded onto the conveyor. At the heading machine, head, dorsal bones, and belly fins are removed. The fish is then taken by hand to the filleting machine, where it is split into two fillets. Backbone and ribs are removed, as well as the black skin.

The fillets travel by conveyors to the skinning machine, and after being skinned, are dipped in a saline solution and placed in a bath. This pickling fluid is prepared in a saline concentrator and is stored in a special tank. It is fed by pump through filters to the skinning machine. Used fluid runs into the bath, and the fluid is then returned to the tank for further use. The fillets then are taken to the packing bench, where they are loaded into trays and dispatched to the refrigerator tunnels.

On the medium-sized fillet line, the scaled fish arrives from the working bay on its conveyor. It is taken off its tray and carried by hand to the heading knife of the filleting machine. After being headed, the fish is drawn automatically into the filleting part of the apparatus. The fillets then follow the large-cod procedure. They return to the working bay, and from there are conveyed to the skinning machines. After being skinned, they are sprayed with pickling fluid. The washed fillets are then stored in a bath until they can be packed into trays.

Whole-fish line.--On the frozen whole-fish line (block freezing), the fish travels down an

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0.5 (Cross Reference: 2.01)

genus Pseudomonas give often unsatisfactory and sometimes contradictory results. To overcome this difficulty, Seleen and Stark (1943) and Liu (1953) recommended substrates in which the carbohydrates to be tested are used as the sole source of carbon and the nitrogen is supplied in the form of an ammonium salt. The sodium salts of several organic acids also were tested. In these media, all 20 cultures gave similar results. Under these conditions, many of the carbohydrates not utilized in the ordinary sugar broths were readily attacked when used as the only source of carbon and in the absence of complex nitrogenous materials.

pH tolerance for growth.--The pH range that permitted growth varied with the substrate used. On nutrient agar, only 9 of the 20 cultures grew at pH 5.1; all grew, but not abundantly, between pH 5.4 and 6.6; all cultures showed a noticeable increase in growth at pH 7; and all cultures grew well between pH 7.0 and 8.8.

Salt tolerance.--In broth cultures, these organisms grew well in the presence of 1 to 3 percent sodium chloride (NaCl); 4 to 6 percent NaCl retarded growth for several days; and 7 percent or more NaCl entirely inhibited growth. The substitution of sea water for tap water did not enhance the ability of these organisms to grow in any of the media that were tested. Whether or not these organisms were of marine origin was not indicated.

Sensitivity to antibiotics.--Preliminary tests with six cultures of Pseudomonas fragi showed that they were very sensitive to chlortetracycline and tetracycline; moderately sensitive to oxytetracycline and streptomycin; slightly sensitive to chlormycetin, polymyx B, and neomycin; and relatively insensitive to penicillin, bacitracin, dehydrostreptomycin, erythromycin, viomycin, and magnamycin.

Inhibition of Pseudomonas fragi by sodium nitrite.--Sodium nitrite ($NaNO_3$), in concentrations ranging from 10 to 10,000 p.p.m., was added to nutrient broth buffered at pH 6.5, 7.0, 7.5, and 8.0. These media were inoculated with four strains of Pseudomonas fragi and were incubated at 25° C. The maximum amount of $NaNO_3$ that permitted growth during 72 hours of incubation ranged from 100 to 10,000 p.p.m. An incubation period of 18 days did not change these limits.

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inclined chute into the working bay and along to the header. After being headed, it is taken by bucket conveyor to the washing machine and then by tray to the sorting bay. From this section it is carried to the packing bench, where it is loaded on a tray for dispatch to the refrigerating tunnels.

The refrigerating section consists of two freezers, each having two quick-freezing tunnels, air being blown by fan over the direct-freezing grids. The fish are loaded into trolley-mounted wire cages. The tunnels are fitted with hydraulically operated moving doors, which can be heated to assist movement.

On leaving the quick-freezer, the trolley is wheeled to the glazing machine, placed on a wire mesh conveyor, and passed through a 15° to 25° C. pressure spray of sea water. This causes the frozen blocks of fish to separate from the trays. The blocks are then sprayed with fresh water at a temperature of 2° to 3° C., causing an ice crust to form on the surface of the fish.

The glazed blocks are now transported to the sorting table, and from there, to the packing tables. Here they are wrapped in waxed paper, weighed, marked, and then sent down the roller conveyor into the refrigerated fish hold.

Canning.--The livers are poured from the buckets into the collecting bath, where they are sorted. The best livers are chosen for canning, whereas those unsuitable for this are dispatched to the liver boilers. Livers for canning are skinned and then packed with salt and spices into the cans, sealed by the canning machine, and loaded in baskets into the canning retorts. Here they are sterilized by means of saturated steam under positive pressure. After this the cans are cooled with cold fresh water to a temperature of 40° C. At this temperature they are removed from the trap and placed on the packing table, where they are loaded into boxes. These are then lowered by tackle into the hold.

The liver-boiling plant is designed to treat 1.6 tons per day. The fish-meal plant can process 20 tons of fish offal and waste per day.

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source that delivered approximately 3×10^5 roentgens per hour. Samples for irradiation were prepared in the following ways: (1) Crystalline sugars were vacuum sealed in a polyethylene-polyester combination film. (2) Aqueous 50-percent solutions of sugars were sealed in glass bottles that had been swept with nitrogen. (3) Crystalline sugars were heated in closed glass containers in an oven at 100° C.

The treated sugars and sugar solutions were assayed for their content of reducing substances and reductone. The ultraviolet spectra and paper chromatograms also were examined.

Results and discussion.--After being irradiated, the crystalline sugars were slightly colored: glucose and sucrose were light brown, and fructose was gray. Sorbitol remained colorless. The color did not change when the irradiated compounds were stored in a desiccator for several months. The color appeared to be on the surface of the sugar crystals because it could be removed by washing the crystals with water.

Irradiated 50-percent aqueous solutions of the sugars were colorless immediately after irradiation, but they usually developed a brown color upon standing for several hours at room temperature. Sorbitol solutions remained colorless.

Conclusions.--The heated sugars gave ultraviolet spectra characteristic of furfural derivatives, indicating that thermal degradation occurs via dehydration. The ultraviolet spectra of irradiated sugars were those characteristic of reductones, enediols, or enols, indicating that irradiation degradation occurs via dehydrogenation. The spectra of irradiated sugars were more like the spectra of enols than like those of reductones; the absorption maximum of a reductone spectrum shifts with pH, but the height of the maximum remains approximately the same, whereas for an enol spectrum and the spectra of the irradiated sugars, the maximum is higher at the higher pH value.

Reductones were shown to be present in irradiated crystalline sugars but not in irradiated sugar solutions. These results suggest that any reductones or their precursors formed by irradiation of sugars in aqueous solution may be destroyed as a result of the greater mobility of the sugar molecules in solution as compared to that of the crystal. Of course, it is not known whether reductones exist as such in the irradiated sugar crystal or whether they are formed from a precursor, such as a stable free radical, when the crystal is dissolved. Irradiation of anhydrous (liquid) glycerol produced no reductones.

0.5 (Cross Reference: 2.01)

monocarboxylic acids. The fruity-smelling compounds are probably volatile esters formed after bacterial deamination of amino acids. Under some conditions, Pseudomonas fragi are able to produce sour-onion and garlic-like odors. These odors also are produced through the action of the bacteria on amino acids, but they are not restricted to the mono-amino monocarboxylic group. Nothing is known yet of the mechanism by which onion-like odors are formed. These bacteria also are able to produce (1) cabbage, sour cabbage, and rotten vegetable-like odors from methionine; (2) cooked egg yolk and hydrogen sulphide-like odors from cysteine, cystine, and glutathione; and (3) various sour vegetable-like odors from other amino acids.

Discussion.--Early workers believed that spoilage of fish muscle occurs in two stages: (1) the reduction of trimethylamine oxide coupled with the oxidation of lactic acid and (2) the hydrolysis and subsequent decomposition of the proteins. In the spoilage of most sea fish, these two stages of decomposition do take place, but they are only part of a more complex series of changes. Increasing attention is being given to the presence of free amino acids and other closely related compounds in the muscle of fresh fish.

Results.--The data recorded in this paper indicate that the sweet, fruity, oniony, and vegetable-like odors produced by Pseudomonas fragi are the result of the action of these bacteria on different amino acids. It is conceivable that most, if not all, of the early spoilage odors listed by Shewan et al. (1953) are produced by organisms similar to Ps. fragi acting on these nitrogenous extractives. The question is how amino acids can be acted upon to produce both fatty acids and alcohols. The former can be produced by a number of different reactions involving deamination, whereas decarboxylation could result in the production of a primary alcohol. According to Gale (1940), the optimum pH values for deamination and decarboxylation are not likely to occur simultaneously; therefore, decarboxylation must occur first and must be followed by deamination at a higher pH. This may be the explanation of why an initial acid reaction favors the production of strong fruity odors, whereas at initial pH values above 7.5, they do not develop.

1.953 WHALING FOR POCKET MONEY

Tench, C. V.
Canadian Fisherman 46, 21-22 (February 1959)

Beluga whales are hunted in a 5-mile stretch of tidal water in the Churchill River where it empties into Hudson's Bay. These white whales, small members of the whale family, are toothed cetaceans with the scientific name Delphinapterus leucus, and are related to the dolphin and porpoise. Their average length is about 12 feet, and their weight is around 1200 pounds.

In whaling for belugas, little is needed in the way of equipment: a sturdy canoe powered by an outboard motor, a few light harpoons, a few buoys made from empty gasoline cans, and a .30-30-calibre carbine with a supply of ammunition.

The hunters cruise the tide-water section of the river from late in June until the middle of September each year. The belugas enter the river from the bay with the incoming tide. Vapor-laden air, blown out at high pressure, forms the spout by which the hunters sometimes locate their quarry. Because the beluga's spout cannot be seen from any distance, the hunters usually sight their catches by looking for white shapes in the water.

One man in each canoe operates the motor in accordance with the direction of his partner, who stands in the bow ready to hurl his harpoon. Belugas are easy to follow because they surface frequently for air. They travel at a speed of about 6 knots, whereas the power canoes travel at 12 knots; consequently, the whales have little chance of escaping.

The best hunting is at high tide on calm, sunny days. The hunters then can maneuver the whales into shallow water and prevent deep diving after the harpoons are driven home. The bow man usually

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 ABSTRACTER: Kathryn L. Osterhaug

2.116 THE ECHO SOUNDER PART 2. THE TREND TO CATHODE RAY AND ASDIC SOUNDERS

Richards, B. T.
Western Fisheries 57, 16-18, 42, 43 (February 1959)

Fishermen are demanding increasing amounts of detailed information of the type that is supplied by echo sounders. Because their demand in large part determines the production rate of models of echo sounders, the fishermen have the most influence on design of equipment and on pricing. Fishermen, because they operate during a limited season, always are searching for faster and more efficient systems of locating fish. The echo sounder now is one of the most competitively priced pieces of equipment on a boat.

Sounders as a whole may be said to be following three lines of development simultaneously: (1) towards showing more detail, (2) toward faster, more accurate locating of fish, and (3) toward better design, greater serviceability, and lower price.

The first information expected of an echo sounder was the location of the bottom and the position of any fish schools in the vicinity. Later, by observing the intensity of the trace on the chart, clues indicating the number of fish in a school began to be obtained. These finer variations were the result of improvements in the design of the receiver and transmitter. At present, much work is being done (1) to differentiate between the bottom and fish that are very near the bottom, (2) to record single fish, and (3) to differentiate between various types and sizes of fish, whether singly or in schools.

The paper recorder probably will always be the main type of presentation because it has many advantages. Work is still being done to improve its sensitivity. A recent idea is what is called

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 ABSTRACTER: Kathryn L. Osterhaug

2.01 SEAWEEDY ODOURS IN COD AND HADDOCK

Castell, C. H. (Fishery Technological Station, Halifax, Nova Scotia)
Canadian Fisherman 46, 14-16, 19 (February 1959)

In the past, researchers at the Fishery Technological Station at Halifax, Nova Scotia, took it for granted that seaweedy odor is a natural characteristic of many species of fish and an indication of freshness. More recent observations, particularly with haddock, have indicated that a different interpretation of this odor may be in order. These researchers now believe that seaweediness may not always be synonymous with freshness but actually may be one of the earlier stages of spoilage.

A large number of fillets were examined immediately after the fish from which they were cut had been discharged from the trawlers, and observations were recorded of the characteristic odors observed for each individual fillet. Also recorded was the number of days each of these fish had been held in ice before landing. The results of 1,020 of these examinations are given in table 1 (see over). It may be seen that in this particular group of fish the seaweedy odors did not begin to develop until the fish had been stored in ice for more than 3 days. Seaweedy odors occurred at approximately the same stage as did the designation, "not much odor."

The succession of odors, as the storage period progressed, appeared to be (1) fresh fishy odor, (2) not much odor, (3) seaweedy odor, and (4) sour odor.

An evaluation of the experiences of these researchers suggest: (1) Seaweedy odors are not an indication of really fresh fish, but if they develop, they generally do so in iced fish prior to the formation of the first odors known to be caused by bacteria. (2) Shortly after the fish become slightly sour, the seaweedy odor disappears. (3) In most trawler-caught fish, the seaweedy odors begin to develop on the 4th or 5th day and disappear as bacterial activity produces the first definite spoilage odors between the 6th and 8th day. (4) More of the fish caught during the summer months develop seaweedy odors than of those caught during the spring or fall, and the odors are stronger in the summer summer-caught fish. There is some evidence that they may develop at an earlier period in fish caught

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 ABSTRACTER: Kathryn L. Osterhaug

3.12 THE EFFECT OF SEVERAL ANTIFUNGAL ANTIBIOTICS ON THE GROWTH OF COMMON FOOD SPOILAGE FUNGI

Klis, John B.; Witter, Lloyd D.; Ordahl, Z. John (University of Illinois, Urbana)
Food Technology 13, 124-128 (February 1959)

Introduction.--The fungal spoilage of food is familiar to every handler of perishable foods and food products. In meat and fish, the slower growing yeasts and molds become more important when bacterial growth is hindered. Dehydrated, smoked, and salted fish and meats frequently have a moisture content quite adequate for the development of molds and yet tend to hinder bacterial growth. Despite the potential control of fungal food spoilage by the use of antifungal antibiotics, only a limited amount of work has been done on this approach.

Purpose.--The purpose of this investigation was to determine the activity spectrum of available antifungal antibiotics against a variety of yeasts and molds responsible for the spoilage of foods.

Experimental.--The effectiveness of six antifungal antibiotics and sorbic acid in inhibiting the growth of 16 common food spoilage fungi was evaluated. Two testing procedures were used, an agar-plate method and a shake-culture method. Results obtained with the two procedures were comparable. Advantages and disadvantages of the two test procedures were discussed.

Results.--Antifungal antibiotics arranged in order of decreasing effectiveness in producing complete inhibition of the test fungi are myprozine, rimocidin, nystatin, fungizone, actidione, and griseofulvin. Myprozine was only slightly more effective than rimocidin. All test organisms were completely inhibited for 96 hours by 25 p.p.m. or less of these two antibiotics or by 100 p.p.m. of nystatin, the next most effective antibiotic. Fungizone at a concentration of 100 p.p.m. inhibited all

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during the summer. (5) High holding temperatures, immediately after the fish have been caught, accentuate the development of these odors. (6) It would seem probable that uniced, shore fish, especially those caught during the summer months, would be more subject to this complaint than would iced trawler-caught fish. (7) It also seems probable that under certain circumstances, environmental conditions may permit the reactions responsible for the seaweedy odors to develop to such an extent that the fish will become extremely objectionable. (8) If this excessive development of the seaweedy condition occurs, the objectionable odors are more readily observed when the temperature of the fish is raised considerably or when the fish is cooked. (9) The seaweedy odors usually are not observed by examining the whole or gutted fish. They are most noticeable in the tissue immediately under the skin. (10) At the present time, researchers do not know the nature of the compound giving rise to these odors or the mechanism by which they are produced. Some of the facts suggest that the odor may be the result of the action of a tissue enzyme and, perhaps, that oxidation of lipid material immediately under the skin is involved. (11) There is evidence that lowering of the holding temperature immediately after the fish are caught will retard the development of the seaweedy odors and prevent the more serious conditions that sometimes develop.

Table 1.--The predominating odors of 1,020 haddock fillets cut from gutted fish that had been stored in ice in the trawler 1 to 9 days at the time of landing. These fish were all from the same vessel but not all from the same trip.

Fillet odor	Total no. of fish	Number of fish in each age group 1 to 9 days								
		1	2	3	4	5	6	7	8	9
Fresh	122	16	16	42	32	6	0	5	5	0
Not much odor	248	0	0	0	50	23	74	78	17	6
Seaweedy	353	0	0	0	65	88	95	84	21	0
Sour	224	0	0	0	4	0	35	36	62	87
Offensive odors	74	0	0	0	2	4	6	26	22	14

1.953 (Cross Reference: 2.1129)

waits to throw his harpoon until he is alongside the beluga in order to make a good strike. If the animal is hard to approach, however, he can throw from a distance of 10 or 15 feet.

Modern harpoons are made of iron, copper, and wood instead of ivory; otherwise they are similar to those used by the Eskimos for centuries. The wooden shaft is 8 or 10 feet long. A piece of 3/8-inch soft, round iron is driven into one end until about 6 inches of it protrudes. A hollow harpoon tip, usually made of copper, slides over this spike. The top of the tubular tip forms a barb; the other end, left open to slide over the iron spike on the shaft, is flanged to form a curved tail. A length of wire is strung through a hole drilled about halfway between the tail and the barb. This wire is tied to 30 or 40 feet of line, which is attached to a sealed, empty, 5-gallon gasoline-can buoy.

When the bow man sinks his harpoon, the tip is disengaged from the iron spike as the hunter withdraws the shaft, by hand if he is alongside the beluga or with a short length of rope if he has driven from a distance. The curved tail of the tip and the fact that the line is attached at midpoint in it combine to make the pull on the line exert force at right angles to the tip itself, which remains firmly embedded in the whale's blubber.

With the harpoon set and the shaft retrieved, the hunter throws out the buoy, which is now attached to the whale. Usually the wounded animal then makes a series of aimless, desperate rushes, but the red-painted buoy prevents it from becoming lost to the hunter, even when it is under water.

The stern man in the canoe, who has stopped the motor and tilted it so that it will not foul the line, now starts the engine again and follows the erratic course of the stricken beluga. Sometimes the bow man recovers the buoy and, holding the line, lets the beluga tow the canoe until it tires. The harpoon does not kill, and when the mammal surfaces close enough to the canoe for a good shot, it is killed. One bullet through the skull, which is thin and brittle, is usually enough.

The whale is hauled beside the canoe, its flukes are tied to the forward thwart, and it is towed to a whaling factory on shore, where the oil from the blubber is extracted and the meat is processed into food for mink and fox. The rate of payment to the hunter is 1 dollar per foot, overall length.

3.12

but three of the test fungi for a 96-hour period. The concentration of actidione necessary for complete inhibition for 96 hours varied from 1 p.p.m. to greater than 100 p.p.m. Three of the four test yeasts were completely inhibited by 5 p.p.m. of actidione. Griseofulvin, the least active of the test antibiotics, was not active against the yeasts; and only one mold, Sclerotinia fructicola, was completely inhibited for 96 hours by 100 p.p.m. of this antibiotic.

Of the fungi tested, Absidia sp. was the most resistant to the inhibitory action of the test antibiotics, whereas Sclerotina fructicola and Botrytis cinera appeared to be the least resistant.

All test fungi except Aspergillus niger and Zgyosaccharomyces barkerii were completely inhibited for 96 hours by 500 p.p.m. of sorbic acid. These two fungi were not inhibited by 1,000 p.p.m. of sorbic acid when the agar plates were incubated for 2 weeks or when 96-hour shake cultures were subcultured.

2.116

"white lining." The effect is to present the bottom as a dark thin line that is followed by a space or "white line" of no markings and then the usual dark followup that occurs after the bottom indication. The purpose of this arrangement is to discriminate more easily between fish that are on the bottom and the bottom itself. The white line, which is just a hair below the bottom line, gives no errors in sounding as long as the operator realizes that the first line, and not the second line, is the bottom.

In explanation, the transmitted sound pulses reflected from the fish are weaker than are those reflected from the solid bottom. The receiver is designed so that the stronger echoes from the bottom can be blanked out to give no trace. A "delay" is incorporated so that the first signal from the bottom, however, is allowed to get through to show a thin bottom line before the signal from the fish blanks it out.

As paper recorders develop, single fish frequently are seen. The most sensitive device for recording single fish, however, is the cathode-ray type of equipment. The high resolving power of this type of equipment--that is, its ability to show both a difference in the relative size of fish and in their distance apart or from the bottom--is attainable because of the characteristics of an all-electronic cathode-ray tube system.

The maximum range of the scale is 328 fathoms, but any 8-fathom section can be made full scale, and fish can be seen as separate crosslines or blips of light when they are as close as 15 inches apart. An easily seen variation is the width of the crossbar of light, which is a measure of the size of the fish.

As a method of resolving small details, the cathode-ray type of presentation is far superior to the paper recorder. It is not, however, marketed in competition with recorders nor is it anticipated that it will replace the recorders. The full value of the cathode-ray instrument is only realized when it used in conjunction with a recorder.

2.118 SALT CONTENT OF EVISCERATED HADDOCK FROZEN IN SODIUM-CHLORIDE BRINE

Peters, John A. (U. S. Bureau of Commercial Fisheries, East Boston, Massachusetts)
Commercial Fisheries Review 21, 6-9 (February 1959)

If haddock were eviscerated before being frozen in brine aboard the fishing vessel, (1) the cost of freezing the fish would be reduced, (2) more fish could be landed from each trip, and (3) the cost of handling and storing the fish ashore would be reduced.

A potential disadvantage of this practice, however, is the possibility that owing to the increased surface of the fish exposed to the brine, an excessive amount of salt might penetrate the fish flesh.

Objectives. -- The objectives of this study were (1) to determine the influence of various freezing temperatures on the sodium chloride content of the edible meat of eviscerated haddock frozen in 23-percent sodium chloride brine and (2) to determine the effect of thawing in water on the salt content of the edible flesh of eviscerated haddock frozen in 23-percent sodium chloride brine.

Experimental procedure. --The haddock used in this study were obtained from local line trawlers. The fish were eviscerated, washed, and iced immediately after they were taken aboard the vessel. The iced fish were transferred to the laboratory within 24 hours after being caught.

Three 50-pound lots of fish were used in the study. One lot was frozen in brine at 5° F.; another, in brine at 10° F.; and the third, in brine at 15° F. All of the fish were left in the brine for 180 minutes--a period of time sufficient to insure complete freezing of these lots of fish.

The salt content was determined on samples of the frozen eviscerated haddock and on the full-nape fillets cut from water-thawed haddock. One-half of the haddock were sampled at the locations

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 ABSTRACTER: Kathryn L. Osterhaug

2.43 EDIBLE PROTECTIVE COATINGS FOR EXTENDING THE SHELF LIFE OF POULTRY

Meyers, R. C.; Winter, A. R.; and Weiser, H. H. (The Ohio State University, Columbus)
Food Technology 13, 146, 147-148 (February 1959)

Tight-fitting, moisture-proof packaging reduces the rate of quality decline in poultry. In packaging poultry, the elimination of air space, however, is next to impossible because of the irregular shape of the carcass.

Various coating materials are being used on frozen fish and, experimentally, on red meats, but little has been done with spray or dip coatings for eviscerated and cut-up poultry.

This report presents the results of tests in which poultry was treated with various solutions of the marine plant polysaccharides, agar and carrogeenin gel, in combination with antibiotics.

Poultry samples. --Unfrozen chicken necks and backs were used as samples in the test.

Coating materials. -- Solutions of 3 percent agar and 4 percent carrageenin gel were used.

Antibiotics. -- Water-soluble salts of chlortetracycline, oxytetracycline, neomycin, and polymyxin B were used. Two antifungals, mycostatin and sorbistat, were also employed.

Storage temperatures. --Three storage temperatures were used: 75° F., 55° F., and 35° F.

Examination. -- At given intervals--8 hours at 75° F., 12 hours at 55° F., and 24 hours at 35° F. --samples were withdrawn from storage and examined for general appearance, for off-odors, and for bacterial growth.

Results. --The coating materials presented no special problems. Both were easily prepared, they were equally easy to apply. The coatings did not retard microbial spoilage substantially at storage temperatures of 75° F. and 55° F. At 35° F., there was a slight increase in keeping time of coated and wrapped samples compared to that of the noncoated controls. The coatings proved most effective when used with a wrapper in conjunction with the antibiotics.

Use of agar or carrageenin coatings as a vehicle for the application of water-soluble antibiotics

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 ABSTRACTER: Richard W. Nelson

2.119 SAFETY ABOARD FISHING BOATS--SUMMARY OF YEAR'S BEST IDEAS

Anonymous
The Fish Boat (Yearbook) 4, 23-25 (April 1959)

In order to reduce accidents and damage to property on fishing boats to an absolute minimum, a two-point program is required:

1. A safety program that includes both instruction and preventive devices aimed at eliminating the causes of accidents on fishing vessels.

2. Installation of safety equipment aboard the boat so that if an accident occurs, injuries and damage will be kept to a minimum.

The operator of a fleet of boats may find it of value to have a safety engineer give a course of instruction to his skippers and crews. The individual owner, however, usually must be his own safety engineer.

Initially, a study should be made to list and describe the most common accidents in the particular fishery. Instruction in safe working conditions then should be given, and necessary safety devices installed.

Winch accidents. --Accidents involving winches are especially common on fishing vessels. Typical accidents probably would include those in which the hands or other parts of the body or clothing are "wound" onto the winch drum. A second type of accident involves "grabbing" by the gears. A third

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 ABSTRACTER: Kathryn L. Osterhaug

3.4 A NEW SMOKE PRODUCER MAKES ITS BOW

Anonymous
Seafood Merchandising 19, 27 (January 1959)

A new smoke producer, applicable to the smoking of fish, designed to provide a supply of smoke which is readily controllable as regards volume, density and flavor, has made its appearance in England. It was developed by D. L. Nicol of the Humber Laboratory, Food Investigation Organization, Department of Scientific and Industrial Research, Hull, England.

A new smoke producer is designed to fit on to existing smoking kilns, especially Torry kilns.

Mr. Nicol points out that controlling the volume, density and flavor of smoke is rather difficult with any ordinary method of burning sawdust. The new machine makes use of the fluidized bed technique. "In effect," says Mr. Nicol, "we maintain a sandstorm of sawdust in a stream of hot air. This enables all the sawdust to be heated uniformly to a temperature at which it chars and produces smoke but does not actually burn. This gives a great deal of smoke from a relatively small quantity of sawdust."

The air temperature is in the region of 300 degrees C., being maintained by electric heaters with suitable automatic controls. There are arrangements for feeding in fresh sawdust and removing charred material continuously so that the machine is suitable for a plant working a continuous process.

A centrifugal fan blows the smoke produced from the machine to the kiln, and a cyclone separator prevents small particles of sawdust from being carried with it.

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 Reprinted in whole

BRINE FROZEN HADDOCK

SAFETY ABOARD VESSELS

COATINGS FOR FRESH POULTRY

NEW SMOKE PRODUCER

2.119

type stems from sudden surging of the winch wire.

Many of these accidents can be avoided by instructing the winchman in safe practices and then checking to see that he follows instructions. In addition to safe working procedures, it is just as necessary to assure safe working conditions. These might include safety rails to close off the moving parts of the winch, guards over gears and brake bands, and nonskid pedals and controls, with the operating levers clearly marked.

New England Program.--A constructive safety program is being carried out in New England by the Bureau of Commercial Fisheries. One of the first projects of this program was directed toward the need for remote engine controls in the larger fishing vessels. The installation of a manually operated cable control leading from the engine throttle to the pilot house is recommended. This control is neither costly nor complex--and it might prevent a disaster at sea.

Among other safety gear tested by the Bureau of Commercial Fisheries are a double-barreled winch head that would eliminate manual handling of trawl cable on draggers and an aluminum radar target to lead rescue boats to a disabled craft.

Foolproof bilge valve.--Designed to eliminate both air binding and back filling, the foolproof valve does away with the need for check valves. It is built with a tapered center cylinder or plug that revolves when the valve is switched from one suction line to another. Water is admitted through a single port in the center plug, which lines up with each suction line in turn. When the center port is lined up with the seacock suction, for example, all other suction lines automatically are blanked off and sealed. No two suction lines can be open simultaneously.

An added safety factor is a remote control for the valve that consists of a rod connecting the top of the center plug with a lever on deck or in the wheelhouse. The bilge pump instantly can be switched to the seacock and thus can make water immediately available for fighting fire; yet no one need enter the engine room.

Miscellaneous.--Other areas that must be checked for safety include the engine room and the deck. Life-saving equipment that is to be carried on board each vessel for use in case of shipwreck is specified by the Coast Guard. This equipment should be inspected periodically to be sure that it is in operating order and that everyone on board is thoroughly familiar with its location and use.

3.4

Mr. Nicol says that the new smoke producer has taken about 4 years to develop and has just about reached the stage of reliable and satisfactory performance. It has not yet been used commercially.

2.118 (Cross Reference: 3.2342)

designated in figure 2 - I. These samples were taken from the frozen fish with a rotary core sampler. The remaining fish were thawed in running water, filleted, and sampled by means of a cork borer of the same diameter as the rotary sampler. The samples were taken from the same locations as those from the frozen fish (Figure 2 - II).

Results.--Table 1 shows the average percentage of salt in the core samples. Data collected at the East Boston Laboratory indicate that the taste threshold for salt in haddock is between 0.5 and 0.6 percent and that a salt content of 0.9 to 1.2 percent is the optimum for palatability.

Conclusions.--(1) The meat representative of the usual commercial quarter-nape fillet from eviscerated haddock frozen in brine at 5°, 10°, or 15° F. and sampled while still frozen did not contain salt in excess of the optimum amount for palatability, but it did contain salt in excess of the taste threshold.

(2) The quarter-nape fillet from haddock thawed in water contained salt in amounts below the taste threshold for salt in haddock. The amount of salt left in the meat after it was thawed in water increased as the temperature of the freezing medium increased.

Table 1 - Average Percentage of Salt in Brine-Frozen Eviscerated Haddock 1/

Core 2/ Section	Salt Content of Fish Sampled While Still Frozen After Having Been Frozen at a Brine Temperature			Salt Content of Fillets From Fish Thawed in Water for 200 Minutes After Having Been Frozen at a Brine Temperature of		
	5° F.	10° F.	15° F.	5° F.	10° F.	15° F.
	(Percent)					
A	0.57	0.69	0.58	0.18	0.32	0.34
B	0.60	0.73	0.49	0.20	0.29	0.46
C	0.50	0.68	0.68	0.18	0.24	0.23
D	0.60	0.70	0.61	0.22	0.28	0.39
E 3/	2.26	2.83	2.85	0.48	0.66	1.45
F 3/	2.84	2.59	2.49	0.61	0.54	0.85
Average of all cores	1.23	1.37	1.28	0.31	0.39	0.62
Average of cores A, B, C, D	0.57	0.70	0.59	0.20	0.28	0.36

1/ Previous tests (Holston and Pottinger 1955) showed that the salt content of haddock should not exceed 1.2 percent for maximum acceptability, and that the natural salt content of haddock meat is between 0.14 and 0.20 percent.
2/ See figure 2 for location of core sections.
3/ These cores were located in the nape section, which is discarded in commercial practice.

2.43

proved successful. Chlortetracycline and oxytetracycline gave comparable results when incorporated into the coatings. The two tetracyclines were more effective when incorporated in the coating materials in combination with other antibiotics or antifungals than when applied alone.

Table 2.--Effect of coatings in conjunction with aureomycin (CTC) and mycostatin on wrapped samples

Treatment	Log of viable organisms per gram of sample. Days stored at 35° F.																		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A1	4.2	3.2	4.1	5.4	6.1	6.6	7.7	*7.9	8.1	--	9.3	--	--	9.5	--	9.6	--	--	9.8
A2	4.2	4.2	--	4.6	--	6.3	--	*7.8	--	9.4	--	9.6	--	9.5	--	9.6	--	9.4	--
A3	4.2	3.9	--	4.2	--	5.3	--	5.5	--	5.9	--	6.9	--	*8.1	--	8.7	--	9.3	--
A4	4.2	3.6	--	4.0	--	5.2	--	4.5	--	4.7	--	6.3	--	6.0	--	*7.5	--	9.1	--
B2	4.4	4.5	5.1	--	5.4	--	5.7	--	5.8	--	*8.8	--	7.6	--	8.4	--	8.5	--	9.2
B3	4.4	--	4.3	--	4.5	--	5.0	--	5.7	--	5.8	--	7.6	--	*7.5	--	8.3	--	9.1
B4	4.4	--	4.5	--	4.5	--	5.0	--	5.5	--	5.9	--	7.1	--	7.9	*--	8.1	--	9.2

Key:
A1--Control, no coating or antibiotics
A2--Agar coated samples
A3--Agar coat containing 15 p.p.m. CTC
A4--Agar coat containing 15 p.p.m. CTC and 10 p.p.m. Mycostatin
B2--Carrageenin coated samples
B3--Carrageenin coat containing 15 p.p.m. CTC
B4--Carrageenin coat containing 15 p.p.m. CTC and 10 p.p.m. Mycostatin

* Time at which spoiled odor became evident.

3.19 IMPROVEMENT IN QUALITY OF ICED WHITE FISH - RADIATION PRESERVATION

Anonymous
Food Investigation 1957, Report of the Food Investigation Board (Great Britain), pp. 5-6 (1958) (London)

Radiation preservation.--Two experiments have been conducted in collaboration with the team at the Low Temperature Research Station that is studying preservation by electronic radiations. In the first, a variety of species--haddock, codling, lemon sole, mackerel, and herring--were irradiated at doses varying from 0.25 to 3.5 million rads, and the effects were assessed by the Torry taste panel. From this preliminary trial, the team concluded that low dose levels were the most suitable for fish. Cod and sole were least affected in appearance, smell, and flavor.

In the second experiment, therefore, only codling were used. Fillets cut from these codling were packed in polyethylene bags, transported in ice to Harwell, and irradiated with a cobalt 60 source of γ rays at 1.0, 0.5, and 0.25 million rads. One additional lot of fillets, irradiated at 0.25 million rads, was dipped in a solution of 20 p.p.m. chlortetracycline (CTC) for 30 minutes before being packaged. The two control lots of fillets that (a) were entirely untreated and (b) were dipped in 20 p.p.m. of CTC for 30 minutes were kept at Torry. Immediately after the irradiated lot of fillets was packaged, it was (1) returned in ice to Aberdeen and (2) divided into two sublots. One of these sublots was stored at 60.8° F., whereas the other sublot was stored at 32° F. The first sublot was sampled daily, and the second sublot was sampled twice weekly.

The most significant feature of the results was the greatly enhanced keeping quality of the fillets dipped in the antibiotic and then irradiated at 0.25 million rads. After 2 days of storage at 60.8° F., only these fillets were acceptable to the taste panel. Entirely untreated fish fillets approached inedibility after 9 days at 32° F., counting from the day of sample preparation. Irradiated samples of

 ABSTRACTER: Martin Heerdt

3.2382 FACTORS AFFECTING WATER-VAPOR TRANSFER THROUGH FOOD PACKAGING FILMS

Karel, M.; Proctor, B. E.; and Wiseman, G. (Department of Food Technology, Massachusetts Institute of Technology, Cambridge)
Food Technology 13, 69-74 (January 1959)

Introduction.--The selection of a packaging film profoundly affects the ultimate quality of food products as they reach the consumer. Water-vapor permeability is one of the most important properties of packaging films. Most tests have been conducted at specific conditions of temperature and humidity, and the application of such data to other combinations is not always possible.

The objectives of the study were (1) to determine the water-vapor permeability of several commonly used packaging films at various conditions of temperature and humidity and (2) to investigate the applicability of theoretical equations for prediction of water-vapor permeability at given conditions of temperature and humidity on the basis of data obtained for other conditions.

Materials tested were (1) plain cellophane (lot A, 1.25 mils; lot B, 1.30 mils), (2) polyethylene-coated cellophane (1.50 mils), (3) saran-coated cellophane (1.10 mils), (4) saran (1.25 mils), (5) polyethylene (3.20 mils), (6) pliofilm (1.80 mils), (7) polystyrene (3.15 mils), and (8) mylar.

Methods.--A modified standard TAPPI method was used. Theoretical equations were derived for water-vapor permeability and were expressed in two types of units: (a) moisture-vapor-transferate, MVTR, in units of $\frac{\text{(grams) (mils)}}{\text{(24 hrs.) (100 in}^2\text{)}} = Q$ and (b) permeability constant, in units of

$$\frac{\text{(grams) (mils)}}{\text{(24 hrs.) (100 in}^2\text{) (cm. Hg)}} = P.C.$$

(over)

 ABSTRACTER: Max Patashnik

3.231 WHAT FROST ACTION DID TO A COLD STORAGE PLANT

Hamilton, J. J.; Pearce, D. C.; and Hutcheon, N. B.
ASHRAE Journal 1, 54-58 (April 1959)

This is a study of a Cornwall, Ontario, conventional, single-story, reinforced concrete locker plant built on shallow spread footings with a floor slab that consisted of two 3-inch reinforced concrete layers separated by 6 inches of cork insulation. To provide a ventilating duct system below the slab, hollow structural clay tiles were laid end to end in parallel rows terminating in 9- by 9-inch headers formed in the concrete at each end.

Heaving begins.--When the plant was put into service in 1951, the freezing room was maintained at -20° F., and the locker room was maintained at -5° F. Eventually, both rooms were combined into one large room that was maintained at -10° F. Heaving of the floor slab first appeared in the original locker area in 1956 and continued rapidly until the floor slab had moved upwards a maximum of 11 inches and the column footings had moved upwards to a lesser degree.

Study of heaving.--During the first phase of the study, two strings of copper-constantan thermocouples were installed through holes drilled in the floor at 1-foot intervals with a rotary air drill. One string was placed near the footing of an interior column, whereas the other string was placed at approximately the center of the bay where maximum heaving had occurred. By April 1957, the subsoil had frozen beyond the 9-foot depth. Preliminary estimates of the amount of heat necessary to thaw the underlying subsoil were obtained from plots of the observed temperature profiles and estimates of the thermal properties of the soil. These estimates indicated that a positive circulation of warm air through the existing tile duct system would bring about complete thawing in about 1 year.

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 ABSTRACTER: Martin Heerdt

4.86 EXPERIMENTAL STUDIES TO EXTEND USES OF FISH OILS IN THE LEATHER INDUSTRY PART I - EXPERIMENTS WITH MENHADEN OIL

Mattei, Victor and Roddy, W. T. (Tanners' Research Laboratory, University of Cincinnati, Cincinnati, Ohio)
Commercial Fisheries Review 20, 7-11 (November 1958-Supplement)

1. The leather industry offers a potential expanded use of fish oils, particularly in fat liquoring.

2. The process of fat-liquoring consists of treating tanned wet skins or hides with an oil-in-water emulsion, which after the leather is dried, gives the finished product flexibility and serviceability.

3. Although menhaden oil is the fish oil produced in largest quantity, the ease of oxidation and polymerization poses certain problems for fat-liquoring.

4. Two possible ways of reducing the tendency of menhaden oil to oxidize and polymerize are to epoxidize and to sulfate the oil.

5. The studies on epoxidation have not been completed, but the patent literature indicates that epoxidized oil can be used for oiling and waterproofing leather.

6. Sulfation of menhaden oil presents difficulties. The reaction is extremely rapid by regular procedures and is accompanied by excessive oxidation. A procedure developed during the present work and for which a public-service patent is being sought, however, reduces the hazards involved.

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 Authors' summary

RADIATION PRESERVATION

FROST HEAVING

PACKAGING FILMS

FAT-LIQUORING LEATHER

3.231

Thawing.--The locker room was taken out of service in June 1957, and modifications necessary for the thawing operation were made. A duct system with a capacity of 1000 cubic feet per minute (CFM) from each of the three sections was designed, and a centrifugal fan with a capacity of 3000 CFM at 1-inch static pressure was ordered. An existing propellor fan was installed in the new duct system to draw air under the floor and to discharge it to the outside. The propellor fan proved quite effective in producing thawing, as was shown by thermocouple readings taken on August 17, 1957, after the new fan had been operating for about 1 week.

Operation of the new fan was continued until about September 15, at which time a unit steam heater having an output of approximately 70,000 B.t.u. per hour was installed in the locker room to deliver heat directly into the intake opening of the upstream header. The fan system then was modified to exhaust into the storage space. Recirculation of 80° to 85°F. air was continued until thawing was complete. By December 1957, the heave had completely subsided, and the floor slab and interior footings had begun to settle. By March 1958, thawing was complete, and the floor slab, column footings, and roof had reached equilibrium conditions or a maximum differential settlement of minus 2½ inches. Since the roof and floor slabs both had settled, the cause of the final differential settlement was believed to be at depths below the footing and in undisturbed soils below the limits of excavation.

Inspection of the building after completion of the thawing operation revealed (1) that the interior column had returned to its original position and (2) that only hairline cracks remained in the floor slab. Recovery was quite remarkable, considering the extreme movement that had occurred, and the whole operation cost less than $1,000. The building again can be used for low-temperature storage provided an adequate subsoil heating system is installed and the depression in the floor and roof is eliminated. This study has indicated that warm summer air would be an adequate source of heat and that this air could be circulated by the fan used in the thawing operation.

4.86

7. In laboratory studies, chrome-tanned leather was fat liquored with a mixture of 60 parts sulfated oil and 40 parts raw oil prepared from (1) menhaden, (2) cod, and (3) neatsfoot oils.

8. Results of the laboratory study indicated, as was expected, that the neatsfoot-oil fat-liquored leather produced a softer leather. There was also less decrease in extractable grease on aging than there was when either cod oil or menhaden oil was used. No important differences were found in the strength properties of the leathers fat-liquored by the different oils, and none of the leathers produced spew. No significant differences were found between the cod-oil and menhaden-oil fat-liquored leathers.

9. To check on the favorable results obtained in these laboratory studies, the experiments were repeated on a pilot-plant scale. The results were the same as those of the laboratory tests.

10. It is concluded that a satisfactory fat liquor can be made from menhaden oil.

This research was carried out at the Tanners' Research Laboratory of the University of Cincinnati under a contract with the U. S. Fish and Wildlife Service.

3.19

fillets subjected to 1.0, 0.5, and 0.25 million rads approached inedibility after 13 days of storage at 32°F. The irradiated and antibiotic-treated fillets were still edible after 23 days of storage at 32°F.

Although the production of volatile bases presents a somewhat confused picture, several interesting bacteriological features were noted. Fish subjected to 1.0 million rads had, even after a few days at 32°F., less than 10^3 bacteria per sq. cm. of surface; whereas the control lots, one of which was dipped in antibiotic and the other of which was undipped, had counts of approximately 10 and 1000 times greater, respectively. At 32°F., the counts on the controls never exceeded 10^6 to 10^7 bacteria, whereas the counts on the fish simply irradiated at all three dosage levels increased enormously until by the 20th day they reached counts of approximately 10^8. On the other hand, fillets subjected to both irradiation and the antibiotic dip never reached a count of 10^6.

Qualitatively, the most important effect of irradiation appears to be a marked reduction in Pseudomonas types of bacteria. Because these are considered to be mainly responsible for spoilage, the combination of antibiotic and irradiation should result in much improved keeping quality. These results warrant further investigations, since they may help to solve some of the difficulties being encountered in the marketing of prepackaged unfrozen fish.

3.2382

Results.--1. Studies at 37.7°C. and at various humidities--plots of the MVTR, (Q), against partial pressures and relative humidities resulted in theoretically ideal straight-line relationship for mylar and saran films only; other films deviated. 2. Studies at 95-percent relative humidity at various temperatures--plots of the MVTR, (Q), against the reciprocal of the absolute temperature generally were straight lines with a negative slope, but important deviations were noted. For example,, at the lowest test temperature of 2°C., saran, polyethylene, mylar, and saran-coated cellophane showed transfer rates that were higher than those expected by theoretical extrapolation. The permeability constant of polystyrene actually increased with decreasing temperature, thus indicating a behavior opposite to that observed with other types of plastics.

Summary and conclusions.--It is current practice to assume a linear relationship between the transfer rate and water-vapor-pressure differential and between the reciprocal of the absolute temperature and the permeability constant. Results of this work appear to support the following general conclusions:

1. The assumption of a linear relation between water-vapor transfer rate and partial pressure differential appears to be justified for hydrophobic plastics, including saran, mylar, polystyrene, and polyethylene. The deviations occurring in the two last-mentioned materials are slight and could be ignored in practice.

2. In materials based on cellulose, deviations from linearity are of sufficient magnitude to preclude the use of ideal relations in practical calculations.

3. The theoretical relations for dependence of permeability on temperature appear to apply in the range of temperatures between 20° and 57°C. and probably also at somewhat lower temperatures.

4. At temperatures approaching the freezing point of water, deviations from ideal relations become considerable. It appears advisable, therefore, to conduct tests at such temperatures when the intended use of the packaging materials includes refrigerated storage.

5. It appears justified to conclude that a need still exists for basic studies into the mechanism of water-vapor transfer at low temperatures and for further investigation into the relationships between composition and permeability, especially for nonhomogeneous (coated and laminated) materials.

3.27 ULTRASONIC DEFROSTING OF FROZEN FOODS

Brody, A. L. (Whirlpool Corporation, St. Joseph, Michigan) and Antonevich, J. N. (Battelle Memorial Institute, Columbus, Ohio)
Food Technology 13, 109-112 (February 1959)

Fast thawing of frozen foods is desirable because it retards bacterial buildup and loss of color and flavor. It is also desirable because of convenience in handling the foods. In present domestic and commercial practice frozen foods are defrosted by static or moving fluids such as air or water. The rate of thawing, however, even under optimum conditions, is relatively slow because of the low rate of heat transfer between the thawing medium and the interior of the food mass. This heat-transfer rate is limited by the maximum temperature that the outer portions of the food can withstand without beginning to cook.

An ideal method of thawing would be to supply a form of energy that would be absorbed rapidly and uniformly throughout a food mass. Heat generation in material through the absorption of ultrasonic energy has been used in cooking and for therapeutic purposes.

The use of ultrasonic vibrations as an energy source for rapid thawing was tried experimentally on representative frozen foods such as hamburger, strawberries, and whole eggs. Ultrasonic waves first thaw the surface of the frozen food, and since the thawed material absorbs more energy than does the frozen food, the heat is generated in the thawed material. Inasmuch as the thermal conductivity of food is low, local heating results, whereas the bulk of the food remains frozen.

This use of ultrasonic energy to defrost frozen foods is not feasible because of the high energy requirements and costs and because of the energy-absorption characteristics of frozen foods, which are such that internal heating is difficult to achieve.

 ABSTRACTER: Max Patashnik

4.13 THE ORIGIN OF THE MARINE POLYUNSATURATED FATTY ACIDS. COMPOSITION OF SOME MARINE PLANKTON

Kelly, Peter B.; Reiser, Raymond; and Hood, Donald W. (Agricultural and Mechanical College of Texas, College Station)
Journal of the American Oil Chemists' Society 36, 104-106 (March 1959)

Purpose.--Shrimp--Penius sp.--and crabs--Callinectes sapidus, Nitzschia closterium, Chlorella pyrenoidosa, and Platymonas sp.--were cultured in the laboratory and analyzed for their constituent polyunsaturated fatty acids. Phytoplankton and zooplankton catches from the Gulf of Mexico were similarly analyzed. The results were compared with findings obtained in studies with teleost fish.

Experimental.--Brown shrimp, 1 to 3 inches in length, from inlets along the Gulf Coast in the vicinity of Galveston, Texas, were held and fed for 30 days in three tanks containing Gulf of Mexico sea water collected from the same location. Shrimp in tank A received the low-fat diet, shrimp in tank B received a 10-percent cottonseed oil terrestrial-type diet, and shrimp in tank C received a 10-percent menhaden oil marine-type diet.

Twelve blue crabs, measuring 4 to 5 inches between the lateral tips of the shells, were held under conditions similar to those used for shrimp. Their marine diet consisted of fillets of red ocean perch, a rather oily fish whose fatty acids are of the typical marine form. The terrestrial fat diet consisted of lean beef heart. The fat-free diet was formulated from chopped heart and chopped perch fillet that had been minced, extracted with chloroform, filtered, washed with chloroform, and heated in an 80° C. oven until solid. Ten percent cottonseed or menhaden oil was added for the simulated land or marine fat diets.

Platymonas sp.--a marine green alga, Nitzschia closterium--a marine diatom, and Chlorella

(over)

 ABSTRACTER: Martin Heerdt

4.11 DETECTION AND MEASUREMENT OF CIS UNSATURATION IN FATTY ACIDS

Holman, Ralph T.; Ener, Siret; and Edmondson, Page R. (University of Minnesota, Austin)
Archives of Biochemistry and Biophysics 80, 72-79 (January 1959)

Experimental.--This report is concerned with the use of near-infrared spectra (1 to 3 μ) in the direct measurement of cis unsaturation in fatty acids and in related substances. All of the spectra presented here were measured upon carbon tetrachloride solutions in quartz cells of 1-centimeter light path using a Beckmann DK-1 spectrophotometer. The concentrations of mixed fatty acids from natural oils usually were about 20 percent. Purified unsaturated fatty acids were examined in somewhat lower concentrations. Measurements of spectra from 1 to 3 μ were made using a tungsten lamp and a lead sulfide detector at a chart speed of 2 inches per minute (0.07 μ). Drive setting was 10, period was 0.1 second, gain was 10, and scale expansion was 100 percent. Optical density was calculated by taking the difference between the height of the peak near 2.15 μ and its base as described by a tangent to the two neighboring minima near 2.10 and 2.21 μ. The extinction coefficient is defined as $k = D/(g./l.)$ where D is optical density, g. is grams and l. is liters.

Trans unsaturation of the glycerides or methyl esters was measured by absorbance at 10.36 μ using a Perkin Elmer 21 infrared spectrophotometer equipped with NaCl optics. Measurements were made in solutions of approximately 1.0 grams per 10 milliliters in CS_2. Density calculations were made in a manner similar to that described above, and trans content of the sample was calculated using methyl elaidate as standard.

Results.--In initial experiments, the extinction coefficients of 41 different natural fats and oils were measured at 2.15 μ in an attempt to relate absorption to unsaturation as measured by iodine

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 ABSTRACTER: Martin Heerdt

6.54 NUTRITIVE VALUE OF POLLOCK FISH SCALES AS DETERMINED BY RAT FEEDING TESTS

Snyder, Donald G. and Nilson, Hugo W.
Special Scientific Report: Fisheries No. 260, 12 pp. (1959) (U. S. Department of the Interior, Fish and Wildlife Service, Washington 25, D. C.)

Postweaning rats were fed diets containing pollock fish scales (PFS) or a protein supplement of 3 parts casein and 1 part lactalbumin (CL). The latter also was fed at three levels of protein in stepwise substitution of, as well as in place of, the pollock scales. Apparent digestibilities of protein by individual rats were determined in diets fed during this feeding study. The biological value for maintenance and true digestibility was determined for PFS and CL protein.

The data indicate:

1. The mean apparent digestibility is 80 percent when PFS protein is fed at a 9-percent level in the diet to male and female rats. This value of digestibility is not significantly increased ($p => 0.05$) when rats are fed diets in which the CL protein is substituted in part or in whole for the 9 percent PFS. PFS and CL protein is completely digested, as indicated by true digestibility values, when only enough is fed to equal metabolic nitrogen.

2. A level of 9 percent PFS protein as the only source of protein in an otherwise adequate diet is incapable of supporting growth in young rats. This nutritional inadequacy of PFS protein is likely due to a deficiency or imbalance of specific nitrogen nutrients.

3. PFS protein can be utilized by rats as a limited source of protein for growth when

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 ABSTRACTER: Donald G. Snyder

THAWING FROZEN FOODS

ASSAY FOR CIS UNSATURATION

MARINE FATTY ACIDS

NUTRITIVE VALUE OF POLLOCK SCALES

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value. To reduce variability, subsequent measurements were made of free fatty acids obtained by (1) saponification, (2) extraction of the unsaponifiables, and (3) resaponification. These data indicated a closer fit to a linear relationship.

If the amount of trans unsaturation measured by infrared analysis was subtracted from the total unsaturation measured by iodine value, most of the points moved closer to a straight line. In a plot of the relationship between cis unsaturation of fatty acids and $k_{2.15\,\mu}$, the points that represented samples regarded as normal were used to establish the position of the curve. These samples, arranged in order of increasing iodine value, are palmitic acid and the fatty acids derived from hydrogenated lard flakes, bayberry tallow, coconut oil, tucum nut oil, mutton tallow, beef tallow, butterfat, margarine, lard, neatsfoot oil, olive oil, oleic acid, rapeseed oil, rice bran oil, citrus seed oil, walnut oil, corn oil, sunflower seed oil, soybean oil, Alaskan herring oil, soupfin shark liver oil, safflower oil, hempseed oil, linoleic acid, and perilla oil.

Plots of the fatty acids from babassu oil, rat fish liver oil, oiticica oil, grape seed oil, crude menhaden oil, salmon oil, and stillingia oil showed abberations from the normal relationship between cis unsaturation and $k_{2.15}$. Oiticica oil and stillingia oil are known to contain unusual component fatty acids that could yield anomalous iodine values or complicate the measurement of cis unsaturation because of their spectra. Plots of purified samples of the isomers of oleic and linoleic acids were included for comparison. The iodine values in these cases have not been corrected for trans unsaturation. Petroselaidic acid (trans-6-octadecenoic acid) and elaidic acid (trans-9-octadenoic acid) have (1) iodine values equal to oleic acid and (2) extinction coefficients at 2.15 μ equal to palmitic acid. Absorption of cis-9-trans-12-linoleic acid at 2.15 μ was about equal to that of oleic acid and about one-half of the absorption of all-cis-linoleic acid, the natural isomer. Linolelaidic acid (all-trans-9,12-octadecadienoic acid) showed absorption at 2.15 μ equal to that of saturated acids.

Conclusions.--Substances having trans or acetylenic unsaturation do not absorb in the same region as do those having cis unsaturation, and the extinction at 2.15 μ is proportional to the degree of cis unsaturation. Conjugated unsaturated systems absorb weakly in this region, but these isomers are present in only a few vegetable oils. Terminal unsaturated systems, which are not often encountered, possess specific absorption at 2.12, 2.17, and 2.23 μ and therefore could interfere with measurements of cis unsaturation at 2.15 μ.

6.54

supplemented with CL protein in the diet. Decreasing ratios of PFS to CL protein in the diet permit progressively better utilization of the PFS protein.

4. No toxic substances per se are present in pollock fish scales for growing rats.

5. The biological value of PFS protein for maintaining rats is about 60 percent; which is about 30 percent less than for CL protein.

3.27

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pyrenoidosa--a fresh-water alga, were grown at 20° to 25° C. in nutrient solution in 8-liter conical flasks illuminated with 500 to 1,000 foot candles of light. The algae that settled to the bottom of the flasks were withdrawn daily and were frozen. After a suitable quantity of each species had been collected, the samples were freeze-dried, ground, extracted with chloroform, and filtered. Most of the unsaponifiable colored pigments were removed from this chloroform solution, and the oil was analyzed as in previous experiments. Three samples of plankton from the Gulf of Mexico also were analyzed.

Results.--With the exception of the shrimp that ingested cottonseed oil, the response of both shrimp and crab to the diets was the same as that of marine fish. On a low-fat diet, all polyunsaturated fatty acids were appreciably reduced, but they responded quickly to fat added to the diet. The apparent lesser degree of response with shrimp and crab probably results from the short period the diets were fed.

Shrimp on the low-fat diet responded to cottonseed oil with an increase in 2-, 3-, 4-, 5-, and 6-double-bond acids, although none of these are present in cottonseed oil. Shrimp therefore are better able readily to convert acids with a low degree of unsaturation to acids with a high degree of unsaturation than are land animals, teleost fish, or even blue crab. The zooplankton catch contained larger amounts of all the acids, especially those with 5 and 6 double bonds, than did any other organism so far examined in this study.

Discussion.--Animals, including herbivorous land animals, have the ability to add double bonds and chain lengths to dienoic and possibly to monenoic acids. Fish may have greater ability to effect this synthesis than do land animals.

The 1,4-diene structure, if present in marine fatty acids, probably is of the same origin as is the same structure in land-animal acids. This indicates that the 5,8,11 and 8,11,14-eicosatrienoic and 5,8,11,14,17-eicosapentaenoic acids isolated from beef-liver lipides by Montag et al. (1957) and the 5,8,11,14,17-eicosapentaenoic acids isolated from pilchard oil by Whitcutt and Sutton (1956) were probably derived from oleic, linoleic, and linolenic acids, respectively. Differences in the synthesis of polyunsaturated acids by fish and by land animals therefore may be of degree and not of kind.

4.5 TECHNICAL NOTE NO. 49 - MEASUREMENT OF RANCIDITY IN FISHERY PRODUCTS BY 2-THIOBARBITURIC ACID METHOD

Ryan, Boyd A. and Stansby, M. E. (U. S. Bureau of Commercial Fisheries, Seattle 2, Washington)
Commercial Fisheries Review 21, 21-23 (January 1959)

A new addition to the existing methods for measuring rancidity in fishery products is the 2-thiobarbituric acid (TBA) method. The study reported in this paper was designed to compare this new method with the results of organoleptic tests.

Procedure.--The fish used in these tests were herring frozen under two different sets of conditions: one not favoring the development of rancidity and the other somewhat favoring the development. The method that does not favor the development of rancidity is the freezing of fish in blocks and glazing of the blocks heavily with ice. The method that tends to favor the development of rancidity is the freezing of fish in evacuated polyethylene bags; polyethylene has an unusually high permeability to oxygen in comparison with other food-packaging films.

Herring packed by these two methods were allowed to become rancid. At periodic intervals, samples from each group were subjected to organoleptic and TBA tests.

Conclusions.--1. In the present single series of storage tests at 0° F. with herring lightly glazed and sealed in evacuated polyethylene bags or frozen in blocks of tap water, the TBA test for rancidity correlated with the organoleptic test.

2. When the data obtained were expressed at TBA values ($E^{1\%}_{1cm.}$), 0.05 was obtained for trace rancidity; 0.10, for slight rancidity; and 0.17, for extreme rancidity.

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 ABSTRACTER: Kathryn L. Osterhaug

4.91 THE EFFECT ON HUMAN SERUM-LIPIDS OF A DIETARY FAT, HIGHLY UNSATURATED, BUT POOR IN ESSENTIAL FATTY ACIDS

Ahrens, Edward H., Jr.; Insull, William, Jr.; Hirsch, Jules; Stoffel, Wilhelm; Peterson, Malcolm L.; Farquhar, John W.; Miller, Theodore; and Thomasson, H. J.
The Lancet, pp. 115-119 (January 17, 1959) (Reprinted)

When unsaturated fats are substituted isocalorically for fats of more saturated types, the serum levels of cholesterol and phospholipids decrease. Marine oils, which are rich in unsaturation but reputedly poor in essential fatty acid activity, were investigated to determine whether the above serum-lipid effects can be attributed either to net unsaturation or to essential fatty acid content of dietary fats.

A special oil was prepared from body portions of menhaden. The oil was the sole source of dietary fat in the diets of two patients for 8 weeks, and the serum-lipid responses were compared with those obtained during periods in which the source of dietary fat was corn oil, which is rich in essential fatty acids but is lower in unsaturation. The menhaden body oil had an iodine value of 179, a peroxide value of less than 1, Gardner color of 10, a total nonglyceride material content of less than 0.2 percent, a free fatty acid content of 0.1 percent, a tocopherol content of 3.2 mgm. per 100 grams, and lipid phosphorus in trace amounts.

Liquid chromatography was used to define fatty acid composition. Forty-four different acids were found. Saturated acids constituted 30 percent of the total acids by weight, and acids with 4 to 6 double bonds totalled 32 percent. The amount of essential fatty acids was determined chemically and by bioassay and was found to be less than 4 percent of the total fatty acids. Content of unsaponifiable material was less than 0.2 percent.

Metabolic studies.--Two patients were studied continuously for 21 and 22 weeks. A liquid

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 ABSTRACTER: Neva L. Karrick

4.60 COMPARATIVE STUDY OF A FEW COMMERCIAL ANTIOXIDANTS

Pacquot, Charles and Mercier, J. (Laboratorie, General des Corps Gras au Centre National de la Recherche Scientifique, Bellevue, France)
Journal of the American Oil Chemists' Society 36, 20-21 (February 1959)

Purpose.--This study was made to compare the primary antioxidant activity of the principal antioxidants that are available in France.

Introduction.--A true measure of antioxidant activity may not be obtained (1) if a natural fat or oil is used as a substrate so that the results are complicated by the presence of natural inhibitors and (2) if testing is accelerated by exposure to light and the use of a high temperature, such as 100° C. To avoid the effects of these factors, carefully distilled ethyl esters of linseed oil fatty acids were used as substrate, and the tests were conducted at 30° C.

Experimental.--The ethyl esters were prepared (1) by ethanolysis of commercial linseed oil and (2) by distillation of the resulting esters at a pressure of 0.5 millimeters (mm.) of mercury. Only the center fraction collected between 140° and 170° C. and representing 90 to 92 percent of the total material was saved for use. Four batches of esters intended for this study were sealed under nitrogen and stored in the dark in a freezer until used. These esters had a peroxide value of 0, showed small differences in saponification and iodine numbers, and gave essentially the same stability values with any given antioxidant.

Auto-oxidation was carried out with 20 grams of the ethyl esters in 65 mm.-diameter beakers placed, without covers, in an oven maintained at 30° C. Oxidation was followed by iodometric determinations of the peroxide number. Solubilization of the antioxidant was carried out under nitrogen

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 ABSTRACTER: Martin Heerdt

6.133 EXTRACTIVES OF FISH MUSCLE. 2. SOLVENT-WATER RATIO IN EXTRACTION OF FAT AND WATER-SOLUBLES

Dambergs, N. (Fisheries Research Board of Canada, Technological Station, Halifax, Nova Scotia)
Journal of the Fisheries Research Board of Canada 16, 63-71 (January 1959)

Introduction.--The crude extract of fish muscle can be fractionated into three groups: (a) ethyl ether solubles or fat, (b) proteinaceous materials, and (c) nonlipid and nonprotein materials, which for the present purpose, are called water solubles.

Purpose.--The present study explores further the influence of water upon the efficiency of (1) acetone and (2) isopropanol as an extractant for water solubles and proteinaceous materials. The solvent water mixtures were prepared by mixing measured volumes of solvent and water. Determination of the maximum yield of extractives obtainable with the various solvent and water mixtures provides (1) a new approach to a simple and rapid determination of the true amount of extractives in any fish material, (2) a comparison with the extractive efficiency of other solvents, and (3) basic data for the development of extraction processes using industrial solvents.

Materials.--Ten kilograms of fresh cod (Gadus callarias) fillets was minced and dried in a tunnel dryer, finely ground, and redried under reduced pressure at temperatures never exceeding 50° C. This material contained 6.3 percent moisture and 4.1 percent fat on a dry-weight basis. By the end of this experiment, the moisture in this material had increased to 8 percent; the fat, however, remained at 4.1 percent. The amounts of fat and water solubles extracted before and after drying were identical, whereas the amounts of proteinaceous materials extracted after drying had increased by 15 percent. The solvents used were anhydrous acetone of reagent grade, purified isopropanol having 2 percent moisture, and anhydrous ethyl ether of reagent grade.

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 ABSTRACTER: Martin Heerdt

TBA TEST FOR RANCIDITY

COMPARISON OF ANTIOXIDANTS

FAT METABOLISM IN HUMANS

EXTRACTION OF FISH MUSCLE

4.60

with slight heating to 45° C. if necessary or by dissolving the antioxidant in an appropriate solvent and removing it from the substrate esters under vacuum in a flow of nitrogen at a temperature not exceeding 30° C.

Results.--Results are recorded in the form of stability values S and S'. The S value is a measure of organoleptic stability and represents the difference in time required for the test sample and the corresponding control to reach a peroxide number of 20 moles per kilogram or the approximate point of organoleptically detectable rancidity. The S' value is a measure of the induction stability and represents the difference in time required for the test sample and the corresponding control to reach a peroxide number of 100.

Butylated hydroxytoluene and nordihydroguaiaretic acids from different manufacturers had similar organoleptic stabilities and very dissimilar induction stabilities. For a given series of antioxidants, organoleptic stability does not necessarily parallel induction stability. For example, α-naphthol and α-tocopherol were similar in organoleptic stability, whereas the induction stability of the former was twice that of the latter. Tocopherol acetate at 0.01-percent concentration appeared to be prooxidant rather than antioxidant, whereas the same compound at 0.1-percent concentration was only very slightly antioxidant. Metophan, which was a weak antioxidant at 0.01-percent concentration, was very effective at 0.1-percent.

Substances such as lecithin, α-conidendrine, and ascorbyl palmitate, which are quite effective in natural oils, are much less effective in the pure substrate of the oil. This indicates that their effectiveness is based upon a synergism with naturally occurring antioxidants in the oil. TMTD and TETD, which showed relatively weak antioxidant activity, were more effective at high than at low temperatures. NDGA, hydroquinone, and pyrogallol at 0.01-percent concentration and metophan at 0.1-percent were very effective and had long organoleptic and induction stabilities. Gallic acid also was found to be effective when only induction stability was considered. Sustane was effective if only organoleptic stability was considered.

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Extraction procedure.--In preliminary tests, the author established that for each ratio of solvent to water in the extracted mixture, (1) a definite maximum amount of crude extract can be obtained from a given material and (2) the first four consecutive extractions of the sample will yield 95 to 98 percent of this amount. In the extraction procedure adopted, 5.0-gram samples were (1) boiled under gentle reflux for 30 minutes with 50 milliliters (ml.) of solvent, (2) filtered or centrifuged, (3) washed with 25 ml. of the same solvent, and (4) returned to the boiling flask for the next extraction. Each sample was extracted at least four times.

Determination.--Crude extract is defined as the dry weight of material to be found in the filtrate, including the washings, after evaporation of the solvent. Consistent results were obtained by defatting the crude extract first and then calculating its weight by adding together the dry weights of the fat and the defatted residue. Fat was determined as the ethyl ether-soluble fraction of the crude extract in the manner described by Dambergs (1956). Protein was determined from the dry weight of material precipitated with trichloracetic acid by the method of Hoch and Vallee (1953). The water solubles were determined by evaporating the combined supernates and washings from the protein determination.

Results with acetone and water.--The amount of crude extract increased steadily as the acetone was diluted. The amounts ranged from 3.9 percent for dry solvent to 32.7 percent for a mixture of 15 percent acetone and 85 percent water. Water only, in four consecutive extractions, yielded 35.4 percent crude extract. Some water-soluble materials were present even in extracts obtained with dry acetone. The amount increased gradually with dilution of the solvent and reached a maximum of 15.6 percent, or 3000 milligrams per 100 grams of fresh fillet, with acetone extractants containing 40 to 80 percent water.

Results with isopropanol and water.--In the absence of water, the amount of crude extract obtained with isopropanol was slightly larger than that obtained with acetone, owing mainly to the larger amounts of fat and water solubles extracted. Maximum extraction was achieved with diluted solvent that contained about 22 percent water. With isopropanol and with acetone, the maximum amount of extracted water solubles was obtained when the solvent contained 55 to 85 percent water. About 25 percent more crude extract was obtained with isopropanol and water than was obtained with acetone and water. The protein extracted reached a maximum of 17.4 percent with isopropanol containing 65 and 85 percent water.

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3. When the data were expressed in terms of milligrams of malonaldehyde per 1,000 grams of sample, 2.3 milligrams was obtained for trace rancidity; 4.6 milligrams, for slight rancidity; and 7.8 milligrams, for extreme rancidity.

4. Owing to the restriction of the test to one species of fish under one set of conditions, a similar correlation of TBA value with organoleptic test would not necessarily be obtained if the conditions were varied.

4.91 (Cross Reference: 0.4)

mixture that was the sole source of calories was given five times a day. The protein, fat, and carbohydrate composition was 15, 40, and 45 percent, respectively, of the total calories. Corn oil or menhaden oil was the sole dietary fat given during the feeding periods. The patients found the menhaden oil unpleasant in taste, but at no time was there nausea, vomiting, diarrhea, or any evidence of vitamin E deficiency. Corn oil produced a striking decrease in all serum-lipid levels. When menhaden oil was substituted in the diet of patient 1, cholesterol, phospholipid, and triglyceride values were further decreased. Corn oil was again fed, and the serum-lipid levels rose, although not to their previous heights. The levels of cholesterol, phospholipid, and triglyceride in serum of patient 2 were not significantly different during the periods in which corn oil and menhaden oil were fed.

The composition of the fatty acid mixture of each lipid group in the serum of both patients was determined and showed differences during the two dietary regimes. Although the serum-ester groups are influenced by the pattern of acids in dietary fat, alterations in fatty-acid patterns do not necessarily indicate significant changes in utilization of individual acids because the turnover of dietary fatty acids in man is not precisely known. The phospholipids appeared to have the most unchanging fatty acid pattern of the serum-lipid groups. About 50 percent of the acids were saturated except when patient 1 was on menhaden oil and 70 percent of the fatty acids were saturated.

Fatty acids of the cholesterol esters showed the smallest proportion of saturated acids. When corn oil was fed, the cholesterol esters showed a higher proportion of linoleic acid than was present in the corn oil. When menhaden oil was fed, a higher proportion of C_{20}-tetraenes and C_{20}-pentaenes was found in the cholesterol esters than was found in the oil, although C_{22}-pentaenes and C_{22}-hexaenes did not appear in the cholesterol esters. The C_{22}-pentaenes appeared in the triglycerides.

Conclusions.--Results of dietary tests with two patients indicate that the presence of essential fatty acids is not required in order to produce serum-lipid alterations and to decrease serum-lipid levels. The effects on serum-lipid levels were unrelated to essential fatty acid and sterol contents of the dietary fats tested.

6.190 PROGRESS ON INVESTIGATIONS OF NUTRITIONAL VALUE OF FISH-MEAL PROTEIN

Grau, C. R., Ousterhout, L. E., Lundholm, B. C. (University of California, Davis); and Karrick, N. L. (U. S. Bureau of Commercial Fisheries, Seattle 2, Washington)
Commercial Fisheries Review 21, 1-3 (February 1959-Supplement)

An investigation into the nutritional value of fish-meal protein is being conducted jointly by researchers at the Poultry Husbandry Department of the University of California and at the Seattle Fishery Technological Laboratory of the U. S. Bureau of Commercial Fisheries. The objectives of the investigation are (1) to establish the amount of variability that exists in commercial fish meals and (2) to find out what causes the variability.

This paper is concerned with the causes of variability in fish meal and includes studies on (1) the effect of raw material and its condition, (2) the effect of storage, (3) the effect of processing conditions, and (4) the development of chick assays to measure available amino acids.

Effect of raw material and its condition.--In tests on the use of cooked and uncooked, spoiled and unspoiled material, meal dried from cooked fish that had been allowed to spoil did not permit growth of chicks. Meal prepared from (1) cooked fish that had not spoiled or from (2) raw fish, either unspoiled or spoiled, permitted good growth. The cause of the impaired nutritive value of meal made from fish that had spoiled after being cooked is under investigation.

Effect of storage conditions.--Samples of a menhaden meal that had been prepared in a steam-jacketed drier were stored both at room temperature and at -20° F. in atmospheres of air and of nitrogen. After 6 months of storage, none of the samples had deteriorated in protein quality.

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 ABSTRACTER: Kathryn L. Osterhaug

6.193 STUDIES ON EFFECT OF PROCESSING AND STORAGE ON THE CONTENT OF UNKNOWN GROWTH FACTORS IN FISH MEAL

Bird, H. R. (University of Wisconsin, Madison)
Commercial Fisheries Review 21, 4-5 (February 1959-Supplement)

Samples of fish meal prepared both experimentally and commercially were assayed for their content of unknown growth factor by the chick-feeding methods of Barnett and Bird. Included among the samples were eight commercial menhaden meals.

Experimental.--In each assay, a standard sample of fish solubles, which arbitrarily was given a potency value of 10, was fed at several levels. The potencies of the fish-meal samples, when compared with the standard, ranged from 2.5 to 13.8. The comparative potencies of the eight commercial menhaden samples were 13.8, 11.8, 5.4, 5.3, 3.0, 2.7, and 2.7. These variations could not be correlated with any known differences in origin, processing, or storage procedure.

Two samples of menhaden meal were subject to storage studies. Results are given in table 1.

Table 1 - Effect of Storage on the Relative Unknown-Growth-Factor Potency of Two Menhaden Meals

Meal Sample	Storage Conditions			Relative Unknown-Growth-Factor Potency
	Kind of Atmosphere	Temperature	Time	
Number		Degrees F.	Days	Units Per Gram
GF 600	Air	Room	0	6.2-14.7
	Air	Room	44	5.5- 7.0
	Air	Room	210	5.1- 6.4
	Nitrogen	Room	210	8.7-13.6
	Air	-20	210	4.3- 8.1
	Nitrogen	-20	210	8.1- 8.4
GF 601	Air	Room	0	5
	Air	Room	20	6.7- 8.2
	Air	Room	42	5.8- 7.1

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 ABSTRACTER: Kathryn L. Osterhaug

6.195 RAT-FEEDING STUDIES TO DETERMINE NUTRITIVE VALUE OF FISH SCALE PROTEIN

Fellers, C. R.; Lemack, N. I.; Parkinson, L. R.; and Livingston, G. E. (University of Massachusetts, Amherst)
Commercial Fisheries Review 21, 9-12 (February 1959-Supplement)

Thousands of tons of fish scales in recent years have been discarded as waste. Usually they are discharged into the nearly harbor, but unless the tidal flow is strong, pollution may result.

The present study was conducted to determine whether or not the scales from ocean perch, Sebastes marinus, can be included to advantage with press cake in the commercial production of fish meal. The biological value of the protein of pepsin-hydrolyzed scales and raw scales therefore was determined.

Experimental.--Rats were used as the experimental animal in assaying the biological value of the fish-scale protein. The first test series included as sources of protein (1) the nitrogen compounds in raw ocean perch scales, (2) a hydrolyzate from these scales, and (3) casein. The second and third series of tests included the protein from fish meal and various combinations of fish meal with perch and herring scales. Weight gain was used as the criterion for evaluating the nutritive value of the products under test.

Conclusions.--1. Young rats do not grow or even live when fed raw, ground ocean perch scales or a pepsin hydrolyzate of these scales as the sole source of protein at a 9-percent level in an otherwise nutritionally adequate diet. The nutritive value of the ground-scale protein is somewhat better, however, than is that of the hydrolyzed-scale protein.

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 ABSTRACTER: Kathryn L. Osterhaug

6.35 FEEDING TEST WITH CARRAGEENIN

Nilson, Hugo W. and Wagner, John A. (U. S. Bureau of Commercial Fisheries, College Park, Maryland)
Food Research 24, 235-239 (March-April 1959)

Purpose.--The feeding studies reported here were conducted under a co-operative agreement with the Seaplant Chemical Company, New Bedford, Massachusetts, in order that the U. S. Bureau of Commercial Fisheries might better be able to recommend rational use of carrageenin.

Experimental.--Five lots of carrageenin used in feeding studies were purchased on the open market, and two additional lots were supplied by the manufacturer. Lots 1 and 2 contained, respectively by weight, 76 and 75 percent hydrocolloid; 12 and 15 percent moisture; and 25 and 22 percent mineral matter. Their hydrocolloid content, which was the best available index of gum content, was determined by precipitating a 2-percent solution of the sample with 2 volumes of 99 percent isopropanol. Their range (1) in viscosity was 180° to 210° MacMichael, (2) in gel strength was 30 to 60 grams, and (3) in arsenic content was 0.04 to 10.4 parts per million. No histologic evidence of toxicity caused by arsenic ingestion was found.

Male and female mice and rats of two strains each were allotted at weaning time to groups of ten animals each. All animals were housed individually in screen-metal cages on wire-mesh floors in an 80° F. room and maintained on a basal diet. The protein in this diet was furnished by dried skim milk, fish meal, animal-liver meal, meat scrap, soybean-oil meal, wheat, barley, oat groats, corn, and alfalfa meal. Supplementary vitamin sources were fish-liver oil, wheat-germ meal, dried brewer's yeast, and dried whey fermentation solubles. The basal diet contained not less than 23 percent crude protein and 5 percent crude fat and not more than 4 percent crude fiber and 7 percent

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 ABSTRACTER: Martin Heerdt

6.193

Experimentally processed tuna meals that had been cooked and dried at different combinations of time and temperature were tested for potency of unknown growth factor. The results are reported in table 2 (see below).

Summary.--Growth-factor potency of menhaden meals was not measurably decreased by storage for 7 months in air at room temperature. The potency of tuna meals was not measurably decreased by any of the heat treatments tried during cooking and drying. Since the assay for growth factors, being quite variable, does not reveal small differences in potency, however, we cannot say that these factors had no effect.

Table 2 - Effect of Processing Conditions on the Relative Unknown-Growth-Factor Potency of Several Tuna Meals Prepared from the Same Raw Material

Meal Sample	Processing Conditions			Relative Unknown-Growth-Factor Potency		
	Cooking	Drying				
	Time 1/	Time	Temperature	Test 1	Test 2	Test 3
Number	Hours	Hours	Degrees F.	Units/g.	Units/g.	Units/g.
628	0.5	0.5	270	9.1-13.3	4.5- 4.6	4.2-5.2
629	0.5	0.25	390	8.3-17.8	8.4-11.3	3.4-7.8
630	0.5	5	105	10.2-17.0	4.2- 6.9	7.0
631	0.5	3	390	2.4- 9.1	5.4-16.5	3.5-4.9
632	3	0.5	270	-	14.4	7.5-7.6

1/ A batch process at 8 pounds pressure.

6.35

mineral matter. The carrageenin was mixed into the diet at levels of 1, 5, and 15 percent at the expense of equal weights of ground yellow corn and at a level of 25 percent for a fixed ratio of ground yellow corn, wheat, and oats. By comparison, commercial food products seldom contain as much as 1 percent carrageenin on a dry-matter basis. At weekly intervals, all rats were weighed, and their food and water intake for the week was determined. All rats and mice were kept until death, at which time a necropsy was performed to determine if gross evidence of disease was present.

Results and discussion.--Mice and rats on diets that contained the different levels of carrageenin lived as long as did those on the control diet without carrageenin. Lesions suggesting hepatic cirrhosis appeared only in rats that had received 25 percent carrageenin in their diet. This finding appears to indicate a marginal dietary deficiency for the rats only. Most of the rats and mice died from extensive pulmonary infections complicated by metastasis.

Only the rats on the diet that contained 25 percent carrageenin averaged about 90 percent of the mean maximum weight of the negative control group. This decrease in size was apparently due to lowered intake of essential nutrients. The food intake of the rats increased from 101 to 118 grams each week, as the level of carrageenin in the diet was increased, in an effort on the part of the rats to ingest maximum nutrients. Weekly mean intakes of carrageenin were 1, 5, 18, and 30 grams, respectively. The increased weekly mean-water intake was 28, 8, 5, and 4 grams per gram of carrageenin ingested as the level in the diet increased from 1 to 25 percent. This decrease of water intake per gram of carrageenin was probably determined by the physical limit in the volume of food that could be handled by the gastro-intestinal tract. The mean apparent digestibility of carrageenin for rats during the 10th week of the experiment was roughly 50 percent, irrespective of the level fed.

6.190

Effect of processing conditions.--In preliminary studies on the effects of length of time a meal is subjected to a high temperature, one series of meals was dried at 390° F. for time intervals ranging from 15 minutes to 3 hours. In a series of studies on the effects of temperatures, meals were dried for ½ hour at temperatures ranging from 200° to 390° F. at temperature increments of 25° F. Nutritional assays are being made on these samples.

Development of chick assays for available amino acids.--A method used at the University of California to assay the nutritional value of meals measures the over-all protein value and the amino acid balance of the meal. This procedure does not indicate, however, whether or not an excess of any amino acid is present. This information is important, particularly if the fish meal is being used to supplement vegetable proteins that are deficient in one or more amino acids.

Work is now in progress to develop assay methods that will determine the amount of an individual amino acid available to the chick. An assay has been developed that is successful for lysine, methionine, arginine, threonine, and combined methionine and cystine. It also shows promise for histidine, phenylalanine, tryptophane, and combined phenylalanine and tyrosine.

6.195

2. Diets that are otherwise nutritionally complete but contain herring-scale protein in replacement of up to 30 percent fish-meal protein are equal in nutritive value to a similar diet that contains protein from fish meal alone when both are incorporated at a level of 10 percent protein in the diet.

3. Similar diets containing ocean perch-scale protein in replacement of 10 percent fish-meal protein are equal, but a diet containing a 30-percent replacement of fish-meal protein is poorer in nutritive value than is a diet containing protein from fish meal alone when both are incorporated at a level of 9 percent protein in the diet.

8.0 COMPOSITION CHANGES IN PUGET SOUND PINK SALMON DURING STORAGE IN ICE AND IN REFRIGERATED BRINE

Thurston, Claude E. and Groninger, Herman S. (U. S. Bureau of Commercial Fisheries, Seattle 2, Washington)
Journal of Agricultural and Food Chemistry 7, 282-284 (April 1959)

Storage in ice and in refrigerated brine are the two methods commonly used for preserving fish from the time they are caught until they are delivered to the processor or consumer. Pink salmon, Oncorhynchus gorbuscha, owing to its ready availability, was used to compare the effect of the two methods of preservation on keeping quality. The physical and chemical changes that take place in the flesh soon after capture, during storage in ice, and during storage in chilled brine were investigated. Storage periods of 1 to 2 weeks were used because they represent the maximum lengths of time that fish are retained on board the vessel or ashore before being processed.

Preparation of samples.--Samples of pink salmon flesh were prepared (1) from fresh fish, (2) from fish stored in ice, and (3) from fish stored in chilled brine.

Skinless and bone-free samples of salmon flesh were taken from representative sections of the fish, ground in a Hobart grinder, sealed under vacuum, and stored at -18° C. until analyzed. Samples from six male and six female fish provided a basis of comparison between the fish stored in ice and the fish stored in refrigerated brine.

For the iced-storage tests, 15 fish were eviscerated and stored in flake-ice at 1° C. After 8 days, they were examined organoleptically, and samples were removed for analysis. After an additional 6 days, fish from the same batch again were examined, and samples were removed for analysis.

(over)

ABSTRACTER: Kathryn L. Osterhaug

9.3 THE DANISH FISH INSPECTION SERVICE

Jensen, Poul Fr. (Director of the Danish Inspection Service for Fish Products)
Trade News 11, 7, 10 (November 1958)

A law designed to maintain and foster the quality of Danish fishery products was passed in 1950. Aptly known as the Quality Law, it was later revised in 1954. This law pertains to all aspects of trade in fishery products as well as methods of catching, storing, transporting, freezing, preserving, and handling of fish and fish products. Fish for export and domestic use as well as imported fish come under the jurisdiction of the law.

To be certain that there is no confusion in the carrying out of the law, poor-quality fish are defined as those products which because of pathological spoilage, contamination, faulty preparation or any other reason, must be considered unfit for human consumption. The consumer is further protected by the next clause of the law which states that products must not be sold which, although fit for human consumption, are not absolutely fresh. Furthermore, if the products are to be transported and cannot be guaranteed to reach their destination in good condition, they will not be passed by the inspector.

Denmark, which has an area of only 17,000 square miles, is divided into 39 fisheries inspection districts. The decentralized control body, which is known as the Fisheries Inspection Service, places at least one fish inspector in each district. The division of the inspection district and the number of inspectors in each are in accordance with the position and the importance of the fishing ports. At the present time there are 112 people in the Fisheries Inspection Service, and the 39 fisheries inspection districts are supervised by three superintendents.

(over)

Reprinted in part

8.51 STUDIES ON THE PROTEINS OF FISH SKELETAL MUSCLE
6. AMINO ACID COMPOSITION OF COD FIBRILLAR PROTEINS

Connell, J. J. and Howgate, P. F. (Torry Research Station, Aberdeen, Scotland)
The Biochemical Journal 71, 83-86 (January 1959)

Introduction.--According to Connell (1958) cod myosin has shown a peculiar instability as compared with rabbit myosin. This instability of cod myosin cannot be explained by its molecular weight or shape as revealed by sedimentation, diffusion, and viscosity. This study was made to learn if any features of the amino acid composition of cod myosin would distinguish it from rabbit myosin. Actin, the other main fibrillar protein was included in the study, since it also is of interest in a comparison of the amino acid composition of cod and rabbit actin. In addition, cod 'natural' actomyosin--that is, actomyosin prepared directly from cod muscle--has been determined (1) because of its importance as a model substance and (2) because the relative amounts of myosin and actin in the complex can be predicted by determining its amino acid composition. The indirect determination of myosin and actin in natural actomyosin appears to be the only way of measuring the amounts of myosin and actin in fish muscle.

Preparation of proteins.--Myosin, actin, and actomyosin were prepared from the skeletal muscle of freshly killed cod, Gadus callarias, as described by Connell (1958). Myosin and actomyosin were precipitated from the final buffer solution by dialysis at 0° C. against many changes of distilled water over a period of several days. The precipitates were dried with acetone and an ethanol-ether combination in a volume ratio of 1 to 3 and finally were dried in air at room temperature. The actin was purified twice by removing unpolymerized material in the preparative ultracentrifuge. The final pellet of F-actin was depolymerized at pH 8 in 0.1-mM adenosine triphosphate solution applied at the rate of 1 milliliter (ml.) to 10 milligrams (mg.) of protein and desalted by dialysis at 0° C. against

(over)

ABSTRACTER: Martin Heerdt

7.51 PROTEIN ANALYSIS OF SHRIMP WASTE MEAL

Brown, Russel L. (Fishery Products Laboratory, Ketchikan, Alaska)
Commercial Fisheries Review 21, 6-8 (February 1959-Supplement)

It is customary to analyze fish meal for its protein, oil, moisture, and ash content in order to determine its value as an animal feed. In the analysis of shellfish meals, erroneously high values for protein are reported unless a correction is made for the apparent protein contributed by chitin, an N-acetylated glucosamine polysaccharide.

Black and Schwartz (1950) devised a method for the estimation of chitin and chitin nitrogen. Upon investigating their work, the author found that the method, which involved filtration, was laborious and sometimes impossible to carry out. All attempts to improve the technique of filtration failed. A literature search was then made to find a more satisfactory method of analysis for chitin nitrogen.

An investigation of a procedure for the isolation of chitin by Horowitz, Roseman, and Blumenthal (1957) pointed the way to a modification of the method of Black and Schwartz that makes it possible almost completely to substitute centrifugation for filtration.

Procedure.--The determination of the amount of protein in shrimp meal, corrected for the amount of apparent protein contributed by chitin nitrogen, is as follows:

1. Weigh a 5-gram sample of meal into a 250-milliliter centrifuge bottle fitted with a reflux condenser.

(over)

ABSTRACTER: Kathryn L. Osterhaug

8.51

distilled water over a period of 4 days. The protein then was precipitated with 0.1 normal hydrochloric acid until the solution reached pH 4. This precipitate (1) was washed twice with acetone, (2) was washed once with ethanol-ether combined in a volume ratio of 1 to 3, and (3) was finally dried in air at room temperature. The preparations of myosin, actin, and actomyosin had 0.97, 0.29, and 1.94 percent, respectively, of ash and 16.41, 16.40, and 16.50 percent nitrogen on a moisture and ash free basis.

Hydrolysis.--Thirty to 50 mg. samples of the proteins were weighed into 8- by 75-millimeter Pyrex test tubes, and 0.5 ml. of freshly distilled constant-boiling HCl was added to each. Each tube with a sample then was frozen, evacuated, sealed, and heated for 24 or 48 hours in an oven at 110° C. Finally the contents were filtered to remove humin, and the filtrate was made up to volume. The hydrolyzates were held frozen until ready for analysis. Portions for analysis were removed and dried over sodium hydroxide pellets in a vacuum desiccator before being applied to a column of ion-exchange resin.

Determination of amino acids.--Amino acids were separated by elution chromatography on columns of finer than 200-mesh Amberlite IR-210 ion-exchange resin (CG-120, type II). Two-ml. fractions of eluate were collected and analyzed according to the method of Moore and Stein (1954) with the exception that 0.08-percent stannous chloride was used as the reducing agent. Tryptophan was determined on samples of the intact protein by the method of Spies and Chambers (1949). Cystine plus cysteine was determined by performic acid oxidation according to Schram, Moore, and Bigwood (1954). Oxidation was followed by hydrolysis of the protein and separation of the cysteic acid on a 0.9- by 15-centimeter column of IR-120 according to Moore et al. (1958).

Results.--The amino acid compositions of cod myosin, cod actin, and cod 'natural' actomyosin have been determined. Cod myosin and cod actin closely resemble the corresponding rabbit proteins in amino acid composition. The ratio of myosin to actin in cod 'natural' actomyosin was found to lie between 2 and 4:1. This approximates the corresponding ratio in rabbit muscle.

7.51 (Cross Reference: 6.195)

2. Add 100 milliliters of acetone, reflux for 45 minutes using a boiling water bath, centrifuge for 20 minutes at 2,000 r.p.m., and discard the supernatant.
3. Add 100 milliliters of a 70-percent acetone-water mixture, shake well, centrifuge for 20 minutes at 2,000 r.p.m., and discard the supernatant.
4. Add 100 milliliters of 90-percent formic acid, stopper, shake for 18 hours, centrifuge for 15 minutes at 2,000 r.p.m., and discard the supernatant.
5. Wash the residue with acetone, centrifuge for 20 minutes at 2,000 r.p.m., and discard the supernatant.
6. Repeat step 5, substituting 70-percent acetone-water for the acetone.
7. Add 100 milliliters of 5-percent (w/v) sodium hydroxide, reflux for 90 minutes on a steam bath, filter with suction through a sintered glass funnel (coarse porosity), and discard the filtrate.
8. Wash the residue with boiling water once, discard the filtrate, transfer the residue quantitatively to a 250-milliliter Kjeldahl flask with the smallest possible amount of water, evaporate until less than 5 milliliters of water remains, and proceed with the Kjeldahl determination in the usual manner, but digesting for 6 hours.
9. Calculate the percent protein from the amount of nitrogen determined, employing the usual factor of 6.25. (The figure obtained by this method is the percentage of apparent protein contributed by chitin nitrogen.)
10. Subtract the figure obtained in step 9 from the percent of crude protein obtained by the regular Kjeldahl determination.

Conclusions.--The results obtained by the method described are sufficiently reproducible to favor its adoption for use in proximate analyses of shrimp-waste meal.

8.0

For the brine-chilled tests, another group of 15 fish were eviscerated and stored for 8 days in a tank containing 27 gallons of a 3-percent sodium chloride brine held at 1° C. After organoleptic examination and the preparation of samples, fish from the same batch were stored an additional 6 days in ice, after which they were examined organoleptically, and samples were removed for analysis.

Experimental procedure.--Organoleptic evaluations for color, odor, taste, and firmness of flesh were made at the beginning and at the end of each storage period by a panel of judges who are experienced in the handling and evaluation of fish.

Chemical analyses of fish included the percentage determination of (1) moisture, (2) oil, (3) protein, and (4) ash. The ash from each sample was analyzed for sodium and potassium by the use of a direct-reading flame photometer.

Results.--Differences in quality between iced and brine-chilled fish were small. Brine-dipped fillets, however, had a salty taste caused by a salt content that approximated the amount found in commercially canned fish. Although storage of fish in ice subsequent to brine-chilling leached out a large part of the absorbed salt, the level of sodium was still several times that found in fresh fish. The quality of brine-chilled fish appears to be equivalent to that of iced fish.

Large variations in composition were found in the dorsal, ventral, and belly-flap sections of pink salmon, but variations were small in the light meat. Fish that were about ready to spawn showed a great depletion of the oil reserves in all parts of the fish.

9.3

The fish inspector is present when the fish is landed, when it reaches the processing plants and the freezing houses, and until it is ready for the wholesale and export trade. This busy official is also called upon to inspect the processing plants, the sanitation control, quality of the raw materials, production in general, quality of the products, and the labeling or marking of the products.

Supervision of the inspection of fish-processing plants is the responsibility of the Danish Inspection Service for Fish Products. This is indicative of the co-operation between the centralized and decentralized bodies. The more highly skilled technical personnel of the centralized body who comprise this Inspection Service tour the different plants to check that they are meeting the requirements of the Ministry of Fisheries. On these occasions they meet with the local fish inspectors and discuss new regulations which affect both bodies. This service also takes care of the more technical and scientific problems and is consultative to the Ministry of Fisheries in questions regarding fish-processing plants and quality control.

A Quality Committee has been established to assist the Minister of Fisheries in all matters pertaining to the quality control of fish and fish products. The committee consists of five trade representatives, one representative of the health authorities, and one representative of the Ministry of Fisheries.

Those merchants involved in the wholesaling or exporting of fresh or frozen fish must first obtain a permit from the Ministry of Fisheries. A similar provision is in force for the retail trade.

The quality laws also provide the Ministry of Fisheries with the power to determine what establishments shall engage in the manufacturing, freezing, or processing of fish and fish products. Authorization is granted to those establishments which meet the requirements of the Ministry of Fisheries, the Public Health Authorities, and the Directorate of Labour Inspection.

1.12 THE PIGMENTS OF OFF-COLOR COOKED TUNA MEAT

Brown, W. Duane; Tappel, A. L.; and Olcott, H. S.
Food Research 23, 262-268 (May-June 1958)

(Abstract of this article appears under 3.337 page 3 - November 1958)

1.12 (Cross Reference: 9.2)

UNITED STATES TUNA FISHERY, 1911--1958

Power, E. A. (Branch of Statistics, Division of Industrial Research and Services)
Fishery Leaflet 484, 12 pp. (April 1959) (U. S. Department of the Interior, Bureau of Commercial Fisheries, Washington 25, D. C.)

1.71 MIGRATION AND GROWTH OF THE DOGFISH SHARK, SQUALUS ACANTHIAS (LINNAEUS), OF THE EASTERN NORTH PACIFIC

Holland, Gilbert A.
Fisheries Research Papers 2, 43-59 (June 1957) (Washington State Department of Fisheries, Olympia)

Over 13,500,000 pounds of dogfish livers were landed along the Pacific Coast of North America during 1944, the peak year of the fishery. Other sources of vitamin A sharply reduced the demand for dogfish livers in 1950, and by 1955 the fishery had virtually ceased for lack of a market. Catch statistics and recoveries of dogfish tagged off the coast of Washington and Vancouver Island have demonstrated a southward migration of dogfish along the Pacific Coast of North America in the fall and winter and a northward migration in the spring and summer.

1.79 AMINO ACID COMPOSITION OF ELASTOIDIN

Damodaran, M.; Sivaraman, C.; Dhavalikar, R. S.
The Biochemical Journal 62, 621-625 (April 1956)

(Abstract of this article appears under 8.51 page 17 - December 1956)

1.86 A MONSTER THAT SPAWNS HANDSOME PROFITS

Anonymous
Business Week, pp. 90-92, 94, 96 (November 23, 1957)

A review of the Alaska King crab fishery.

1.952 BRITISH COLUMBIA MONSTERS

Tench, C. V.
Canadian Fisherman 45, 15, 16, 50 (December 1958)

1.952 SEA LIONS EAT MOSTLY SCRAPFISH, OCTOPUS

Anonymous
Western Fisheries 58, 62-63, 64 (April 1959)

2.9 (Cross Reference: 9.15)

THE INCIDENCE OF NEMATODES IN THE FILLETS OF SMALL COD FROM LOCKEPORT, NOVA SCOTIA, AND THE SOUTHWESTERN GULF OF ST. LAWRENCE

Scott, D. M. and Martin, W. R. (Fisheries Research Board of Canada, Biological Station, St. Andrews, New Brunswick)
Journal of the Fisheries Research Board of Canada 16, 213-221 (March 1959)

The incidence of nematodes in fillets of Atlantic cod (Gadus callarias) was determined in 1957 in four areas within 10 miles of Lockeport, Nova Scotia, and in six areas in the southwestern Gulf of St. Lawrence. About 1,500 cod, mostly between 1 and 6 years of age, were examined. All nematodes examined (517) were larvae. About 97 percent belonged to the genus Porrocaecum; the remainder appeared to belong to the genus Anisakis. In all areas there was a progressive increase in incidence with increasing age of cod. In age-groups IV and V usually more than 70 percent of the cod were infected. Cod were more heavily infected in inshore than in offshore waters.

2.9 RADIOACTIVE CONTAMINATION OF FOODS EFFECTED BY THE ATOMIC- OR HYDROGEN-BOMB EXPLOSIONS. VII. RADIOACTIVE CONTAMINATION OF SEA FISHES AND SOME RADIOCHEMICAL ANALYSES

Nagasawa, Kakuma; Nakayama, Goichi; Enomoto, Masayoshi; Kametani, Katsuaki; and Kido, Yasumasa
Eisei Shikenjo Hokoku No. 75, 393-402 (1957)
Chemical Abstracts 52, 18951 (November 10, 1958)

No significant change in the radioactivity was detected in 87 livers of tuna and swordfish captured from January 1956 to April 1957 in the southern Pacific Ocean, in spite of H-bomb explosions.

CONVERSION UNITS

1 pound = 453.59 grams
1 ounce = 28.350 grams
1 inch = 2.5400 centimeters
1 gallon = 128 ounces
1 gallon = 231 cubic inches
1 quart = 0.9463 liters
1 ounce = 29.573 milliliters

CONVERSION OF TEMPERATURE SCALES

$F = 9/5\ C + 32$

$C = 5/9\ (F-32)$

SPECIFIC HEAT AND HEAT OF FUSION

Average values of specific heat generally used for fishery products are 0.80 B.t.u. per pound per °F. above freezing and 0.40 B.t.u. per pound per °F. below freezing.

An average heat of fusion generally used for fishery products is 115 B.t.u. per pound. The heat of fusion of ice is 144 B.t.u. per pound.

DEFINITIONS

calorie ..... heat required to raise the temperature of 1 gram of water 1 degree Centigrade

British thermal unit .....252 calories or the heat required to raise the temperature of 1 pound of water 1 degree Fahrenheit

ton of refrigeration ..... removal of heat at the rate of 12,000 B.t.u. per hour

atmospheric pressure, normal .....a pressure at sea level of 14.696 pounds per square inch, absolute

sensible heat .....heat added to the body when its temperature is changed

latent heat ..... heat absorbed or evolved during a change of state, with no change of temperature

heat of fusion ..... heat absorbed when a solid melts, with no change of temperature

heat of vaporization ..... heat absorbed when a liquid vaporizes, with no change of temperature

heat of reaction ....., heat evolved or absorbed during a chemical reaction

heat transmission .....flow of heat by conduction, convection, or radiation, singly or in any combination

horsepower ..... work performed at the rate of 550 foot pounds per second

mechanical equivalent of 1 B.t.u. of heat ..... heat given off by a total expenditure of 778 foot pounds of energy

COMMON ABBREVIATIONS*

A.	Ångstrom unit(s)
a.c.	alternating current
alc.	alcohol, alcoholic
alk.	alkaline (not alkali)
amp.	ampere(s)
anhyd.	anhydrous
aq.	aqueous
at.	atomic (not atom)
at. wt.	atomic weight
Bé.	Baumé
biol.	biological
B.O.D.	biochemical oxygen demand
b.p.	boiling point
B.t.u.	British thermal unit(s)
cal.	calorie(s)
cc.	cubic centimeter(s)
cm.	centimeter(s)
d.	density (d_{13} specific gravity at 13° referred to water at 4°; d_{20}^{20}, at 20° referred to water at the same temperature)
d.c.	direct current
e.m.f.	electromotive force
Et	ethyl (Et_2O, ethyl ether)
e.v.	electron volt(s)
f.p.	freezing point
ft.	foot, feet
g.	gram(s)
γ	microgram(s)
hr.	hour
in.	inch(es)
kcal.	kilocalorie(s)
kg.	kilogram(s)
kv.	kilovolt(s)
kv.-amp.	kilovolt-ampere(s)
kw.	kilowatt(s)
kw.-hr.	kilowatt-hour
l.	liter(s)
lb.	pound(s)
m.	meter(s); also (followed by a figure denoting temperature) melts at, melting at
M.	molar (as applied to concn.)
ma.	milliampere(s)
Mc.	megacycle
mc.	millicurie
Me	methyl (MeOH, methanol)
meq.	milliequivalent
m.e.v.	million electron volts
mg.	milligram(s)
ml.	milliliter(s)
mm.	millimeter(s)
mγ	millimicrogram
mμ	millimicron(s)
mol.	molecule, molecular
mol. wt.	molecular weight
m.p.	melting point
μ	micron(s)
mv.	millivolt(s)
n	index of refraction (n_D^{20} for 20° and sodium light)
N	normal (as applied to concn.)
petr. ether	petroleum ether
p.p.m.	parts per million
ppt.	precipitate
pptd.	precipitated
pptg.	precipitating
pptn.	precipitation
qual.	qualitative (not qualitatively)
quant.	quantitative (not quantitatively)
r.p.m.	revolutions per minute
sol.	soluble
soln.	solution
sp. gr.	specific gravity
sp. heat	specific heat
sp. vol.	specific volume
sq. cm.	square centimeter(s)
U.S.P.	United States Pharmacopeia
v.	volt(s)
vol.	volume (not volatile)
w.	watt(s)
wt.	weight

* These abbreviations are used by Chemical Abstracts and, accordingly, have wide recognition.

3.12 ANTIBIOTICS IN FOOD PRESERVATION

Tomlinson, Neil (Vancouver Technological Station, Fisheries Research Board of Canada, Vancouver, B. C.)
Studies 1957 from the Stations of the Fisheries Research Board of Canada, FRB No. 505 (Ottawa)

A review of studies in the use of antibiotics in food preservation.

3.12 THE EFFECT OF AUREOMYCIN (CHLORTETRACYCLINE) IN THE PROCESSING AND STORAGE OF FRESHLY SHUCKED OYSTERS

Abbey, Anthony; Kohler, Richard; and Upham, Sidney D. (Am. Cyanamid Co., Princeton, New Jersey)
Proc. Natl. Shellfisheries Assoc. 47, 143 (1956)
Chemical Abstracts 53, 3528c (February 25, 1959)

The use of chlortetracycline in concentrations from 1 to 30 p.p.m. was evaluated in the processing and storage of freshly shucked oysters in co-operation with commercial processors by using production facilities and schedules whenever possible. Although unfavorable storage conditions usually were employed, microbial counts and organoleptic tests favored the oysters processed with chlortetracycline.

3.231 NECESSARY EQUIPMENT FOR THE FREEZING OF FISH

MacCallum, W. A. (Atlantic Fisheries Experimental Station, Halifax, Nova Scotia)
Studies 1956 from the Stations of the Fisheries Research Board of Canada, FRB No. 427, 7 pp. (Ottawa)

The role of the ammonia-water absorption machine in the fishing industry will be confined to situations where exhaust steam is available for refrigeration purposes and where boiler fuel costs are low. The cost of the control equipment necessary for proper operation will be a factor in determining the commercial lower limits to machine size. Forced circulation of ammonia refrigerant is being used with satisfactory results in both old and new fish freezing plants.

3.231 SORTS ITEMS BY WEIGHT FOR ACCURATE PORTION CONTROL

Anonymous
Food Processing 20, 39, 108 (April 1959)

Manual weighing of cut-up pieces of fish, meat, or other portion-control foods is slow work. A portion-control-weighing machine has taken over this monotonous weight-classifying task. Cuts of fish are sorted into five groups between 4 ounces and 8½ ounces. Pieces too large or too small for the portion-control pack are automatically eliminated.

3.2381 PRESERVING FISH

Helgerud, Øyvind and Olsen, Alf (to Aktieselskabet Protan and Øyvind Helgerud)
U. S. Patent 2,839,410 (June 17, 1958)

The food is deep-frozen in a thickened salt solution. A typical solution consists of carboxymethyl cellulose 4, NaCl 2.5, and water 93.5 percent. This solution has a viscosity of 900 centipoises at 20°, pH 9.5, and a thawing temperature of -2.5°. The method in general consists of adding a water-solution hydrocolloid (Na alginate, carrageenin, carboxymethylcellulose, carobbean flour, agar, poly(vinyl alc.), or mixture thereof) in an amount of 1.5 to 4 percent to an aqueous salt solution having a concentration of 2.5 to 4 percent. The solution contains NaCl, Na hexametaphosphate, Na_2SO_4, or mixtures thereof.

3.2381 PLASTIC-STARCH DIP FOOD COATING BIDS TO REVOLUTIONIZE POULTRY PACKAGING

Anonymous
Quick Frozen Foods 21, 136 (April 1959)

Two major companies are independently working on edible, transparent starch dips to be used to protect frozen poultry. Results of the research will not be available for several months.

The advantages of the transparent starch dip are that it is light in weight, it is colorless, and it will tightly seal the product, thus eliminating the clouding effect that is a disadvantage of conventional wrapping. The dip, also is expected to be inexpensive, to eliminate freezer burn, and to be less prone to puncture than are conventional film wraps.

4.11 SEPARATION OF THE LONG-CHAIN FATTY ACIDS BY GAS-LIQUID CHROMATOGRAPHY

James, A. T. (Natl. Inst. Med. Research, Mill Hill, London)
Am. J. Clin. Nutrition 6, 595-600 (1958)
Chemical Abstracts 53, 3342e (February 25, 1959)

A description of an inexpensive and simple apparatus that permits automatic analysis of γ quantities of long-chain fatty acids to be made accurately and rapidly.

4.11 ENZYMATIC DETERMINATION OF POLYUNSATURATED FATTY ACIDS

MacGee, Joseph (Miami Valley Laboratories, Cincinnati, Ohio)
Analytical Chemistry 31, 298-302 (February 1959)

A simple and rapid enzymatic method for the quantitative estimation of total cis-methylene-interrupted polyenoic acids has been devised. Linoleic, linolenic, and arachidonic acids were used to calibrate the method. The potassium salts of the fatty acids are oxidized by atmospheric oxygen in the presence of the enzyme lipoxidase, and the absorption of the conjugated diene hydroperoxide is measured at 234 mμ. As little as 5γ of linoleic acid can be quantitatively measured with accuracy and precision. The total content of polyunsaturated fatty acids containing the cis-methylene-interrupted diene structure of fats, oils, hydrogenated oils, fatty acids, esters, blood plasma, microorganisms, and plant seeds has been measured directly by this method.

GLOSSARY OF COMMON AND SCIENTIFIC NAMES OF FISH AND SHELLFISH*

Common name	Other common names	Scientific name
Alewife	Branch herring, big-eyed herring, river herring,	Pomolobus pseudoharengus
	Blueback, glut herring, shad herring	Pomolobus aestivalis
Anchovy		Engraulis mordax
Cod	Codfish	Gadus morhua (Atlantic)
		Gadus macrocephalus (Pacific)
Flounder:		
Gray sole		Glyptocephalus cynoglossus
Lemon sole		Pseudopleuronectes dignabilis
Yellowtail	Dab	Limanda ferruginea
Dab	Sea dab	Hippoglossoides platessoides
Blackback	Winter flounder	Pseudopleuronectes americanus
Fluke	Summer flounder, gulf flounder, flounder	Paralichthys species
'Sole'		Pleuronectidae and Bothidae species
'California halibut'		Paralichthys californicus
Haddock		Melanogrammus aeglefinus
Halibut		Hippoglossus hippoglossus (Atlantic)
		Hippoglossus stenolepis (Pacific)
Herring:		
Lake	Herring	Leucichthys artedi (Great Lakes, except Erie)
Round		Etrumeus sadina
Sea		Clupea harengus (Atlantic)
		Clupea pallasii (Pacific)
Thread		Opisthonema oglinum
Jack mackerel	Horse mackerel	Trachurus symmetricus
Lingcod	Cultus cod, blue cod, buffalo cod, ling	Ophiodon elongatus
Mackerel		Scomber scombrus (Atlantic)
		Pneumatophorus diego (Pacific)
Crab:		
Blue		
Hard	Hard-shelled crab	Callinectes sapidus
Soft and peelers	Soft-shell crab	Callinectes sapidus
Dungeness		Cancer magister
King	Alaska king crab	Paralithodes camtschatica
Rock		Cancer irroratus (New England)
		Cancer species (California)
Stone		Menippi mercenaria
Lobster:		
Northern		Homarus americanus (Atlantic)
Spiny	Sea crawfish, rock lobster	Panulirus argus (Atlantic)
		Panulirus interruptus (Pacific)
Shrimp	Prawn	Penaeus setiferus (South)
		Penaeus duorarum (Atlantic)
		Penaeus aztecus and
		Xiphopeneus kroyeri Gulf)
		Pandalus species (Atlantic and Pacific)
		Pandalopsis species (Pacific)
		Crago species (Pacific)
Menhaden	Mossbunker, pogy, fatback	Brevoortia species
Mullet	Jumping mullet, striped mullet, silver mullet	Mugil species
Ocean perch:		
Atlantic	Rosefish, redfish, red perch	Sebastes marinus
Pacific		Sebastodes alutus
Pilchard	Sardine	Sardinops caerulea
Pollock	Boston bluefish	Pollachius virens
Rockfish	Rock cod, snapper	Sebastodes species (Pacific)
Sablefish	Black cod	Anoplopoma fimbria
Salmon:		
Atlantic		Salmo salar (Atlantic)
Pacific:		
Chinook or king	Tyee, spring	Oncorhynchus tshawytscha
Chum or keta	Fall, dog	Oncorhynchus keta
Pink	Humpback	Oncorhynchus gorbuscha
Red or sockeye	Blueback	Oncorhynchus nerka
Silver or coho		Oncorhynchus kisutch
Spanish mackerel	Mackerel	Scomberomorus maculatus
Tuna and tunalike fishes:		
Albacore	Longfin tuna	Germo alalunga
	---	Thunnus saliens
Bluefin	Horse mackerel	Thunnus thynnus
	---	Thunnus secundodorsalis
Bonito		Sarda sarda (Atlantic)
		Sarda chiliensis (Pacific)
Little	Bonito, albacore, false albacore	Euthynnus alletteratus
Skipjack	Striped tuna	Katsuwonus pelamis
Yellowfin		Neothunnus macropterus
Whiting	Silver hake	Merluccius bilinearis
Clam:		
Cockle		Cardium corbis (Pacific)
Coquina	Pompano shells	Donax variabilis
	Butter	Saxidomus nuttali (Pacific)
Hard	Little neck	Paphia staminea (Pacific)
	Round clam, cherrystone, quahog, little neck	Venus mercenaria (Atlantic)
		Venus mortoni (Florida)
Ocean quahog		Cyprina islandica
Pismo		Tivela stultorum (Pacific)
Razor		Ensis species (Atlantic)
		Siliqua patula (Pacific)
Soft	Soft-shell clam, sand clam, nannynose, maninose	Mya arenaria
Surf	Skimmer	Spisula solidissima
Oyster:		
Eastern	Cove	Crassostrea virginica
Pacific (introduced)	Japanese	Crassostrea gigas
Western	Olympia, native	Ostrea lurida
Scallop:		
Bay		Pecten irradians (Atlantic)
		Pecten aequisulcatus (Pacific)
Sea		Pecten magellanicus

* Taken from Fishery Statistics of the United States 1955. Each species listed was caught in excess of 10,000,000 pounds in 1955.

4.29 REACTION PRODUCTS OF PRIMARY FATTY AMINES AND ALDOSE SUGARS

Erickson, John G. (Minneapolis, Minnesota)
U. S. Patent 2,808,401 (Oct. 1, 1957)

4.29 ALKALI ISOMERIZATION REACTIONS OF UNSATURATED FATTY ACIDS

Lundberg, W. O. (Univ. of Minnesota, Minneapolis)
Am. J. Clin. Nutrition 6, 592-3 (1958)
Chemical Abstracts 53, 3342d (February 25, 1959)

Alkali isomerization spectrophotometric method of analysis is an empirical procedure. It is necessary to establish spectral constituents of the various polyunsaturated fatty acids by alkali isomerizing under the conditions that will be used in analysis measurement of ultraviolet absorption at various wave lengths, and then to establish constituents that may be used in calculating the original compound of alkali isomerized mixtures of polyunsaturated fatty acids.

4.29 PREPARATION OF A COATING MATERIAL BY CHLORINATION OF FISH OIL III. ON THE FIRE-RETARDANT PROPERTY OF THE PRODUCT

Suzuki, Kosaku
Bulletin of the Japanese Society of Scientific Fisheries 24, Nos. 6 and 7, 515-518 (1958) (English abstract, figures, and table)

A chlorinated product was examined for its fire-retarding property toward wood. Pieces of wood treated with a chlorinated fish-oil product generated no flame when heated in an electric furnace.

4.5 THE EXISTENCE OF LIPOXIDASE AND ITS CHEMICAL AND NUTRITIVE TECHNOLOGICAL MEANING

Zimmerman, R.
Ernahrungsforschung 2, 779-86 (1957)
Chemical Abstracts 52, 9241 (June 10, 1958)

Data on the existence of lipoxidase are reviewed and discussed from the standpoint of practical significance in food storage.

4.5 A SYMPOSIUM ON OXIDATION AND ITS PREVENTION. INTRODUCTION. RUSTING OF FISH PRODUCTS AND ITS PREVENTION

Nonaka, Junsaku (Tokyo Univ. Fisheries, Shiba, Tokyo)
Abura Kagaku 7, 317-22 (1958)
Chemical Abstracts 52, 21165f (November 25, 1958)

6.130 OIL AND CATTLE FOOD FROM HERRINGS

Sirnes, Severin
U. S. Patent 2,832,684 (Apr. 29, 1958)
Chemical Abstracts 52, 13140 (August 10, 1958)

A method is described for increasing the output of oil from herring and at the same time improving the quality (due to a lower oil content) of the cattle food produced.

6.131 MODERN COMMINUTING MACHINES FOR THE FISH MEAL INDUSTRY

Suchowski, K.
Fette, Seifen, Anstrichmitt. 59, 442-444 (1957)
Food Science Abstracts 29, 527 (December 1957)

A brief survey of modern technical processes for the utilization of fish waste and the production of fish meal, with special reference to fish press-cake comminuting machines of the Novorotor mill type.

6.32 STUDIES ON MUCILAGE FROM THE SEAWEED, EUCHEUMA MURICATUM (GMEL.) WEBER VAN BOSSE IV. SEPARATION OF ACIDIC AND NEUTRAL SUGARS BY ION EXCHANGE RESINS AND THEIR IDENTIFICATION BY PAPER CHROMATOGRAPHY

Nakamura, Takehiko
Bulletin of the Japanese Society of Scientific Fisheries 23, No. 10, 647-651 (1958) (English abstract, and figures)

V. Identification of glucuronic acid.--Ibid. 652-655. Glucuronic acid or glucurone in the acidic fraction of Eucheuma muricatum was clearly identified by the Williams, the Dische, and by the original naphthoresorcinol reactions. The content was 3.27 percent on the dry basis of the hydrolyzates, when determined by the Williams reaction.

VI.--Ibid. 24, No. 4, 285-288 (1958). The sugar solution obtained by hydrolysis of 1 gram mucilage (Ba salt) with dilute sulfuric acid was neutralized and decolorized and separated into acidic and neutral sugar using ion exchangers. Total neutral sugar amounts to about 80 percent of total sugar.

LIST OF PUBLICATIONS REGULARLY ABSTRACTED

Analyst
Analytical Chemistry
Archives of Biochemistry and Biophysics
Biochemical Journal
Biochemistry (U.S.S.R.)
Bulletin of the Faculty of Fisheries, Hokkaido University
Bulletin of the Japanese Society of Scientific Fisheries
California Fish and Game
Canadian Fisherman
Canadian Journal of Biochemistry and Physiology
Canadian Journal of Chemical Engineering
Canadian Journal of Chemistry
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Processing
Chemistry and Industry
Commercial Fisheries Review
Drug and Cosmetic Industry
Federation Proceedings
Feed Bag
Feedstuffs
Fish Boat
Fisheries Newsletter (Australia)
Fish. Res. Bd. Can., Prog. Repts. Atlantic Coast Stas.
Fish. Res. Bd. Can., Prog. Repts. Pacific Coast Stas.
Fishing Gazette
Food Engineering
Food Manufacture
Food Preservation Quarterly
Food Processing
Food Research
Food Technology
Frosted Food Field
Industrial and Engineering Chemistry
Industrial Refrigeration
Journal of Agricultural and Food Chemistry
Journal of Applied Chemistry
Journal of Biological Chemistry
Journal of Nutrition
Journal of the American Chemical Society
Journal of the American Dietetic Association
Journal of the American Oil Chemists' Society
Journal of the Association of Official Agricultural Chemists
Journal of the Fisheries Research Board of Canada
Journal of the Science of Food and Agriculture
Maine Coast Fisherman
Modern Packaging
Modern Refrigeration
National Fisherman
National Provisioner
Nature
Nutrition Reviews
Pacific Fisherman
Poultry Science
Progressive Fish-Culturist
Quick Frozen Foods
Refrigerating Engineering
Report of the Food Investigation Board (Great Britain)
Science
Seafood Merchandising
Trade News (Fisheries Department, Canada)
Western Canner/Packer
Western Fisheries
World Fisheries Abstracts
World Fishing

Articles chosen for abstracting or inclusion as bibliographical references are those deemed of interest to the commercial fisheries and to fishery technological laboratories. Occasionally pertinent articles from sources other than the above-listed publications are included. Biological papers are generally omitted.

6.33 STUDIES ON THE ANTISEPSIS OF AGAR DURING THE MANUFACTURING PROCESS IN THE MILD WINTER II. ON THE PHYSICOCHEMICAL CHANGES OF AGAR AND ITS INTERMEDIATE PRODUCT, "TOKOROTEN" IN THE SPOILAGE

Fujisawa, Hiroaki and Sukegawa, Terutake
Bulletin of the Japanese Society of Scientific Fisheries 23, No. 6, 306-314 (1957) (English abstract, figures, and tables)

Physicochemical properties of gelidium jelly often change during bacterial spoilage and the quality of the agar prepared is affected. The amount of reducing sugar increases slowly but the relative viscosity and the jelly strength decrease rapidly during spoilage. Causative micro-organisms were chromobacteria producing red, orange, yellow and yellowish-orange pigments, and an agar-decomposing bacterium. These bacteria were substantially derived from the tainted reed mat on which the jelly lay.

III. Bacteriostatic effects of antiseptics on the causative bacteria in the spoilage of agar and its intermediate product, "Tokoroten".--Ibid. 23, No. 10, 641-646 (1958). Benzalkonium chloride, hydrogen peroxide, and sodium hypochlorite inhibited remarkably the growth of an agar-decomposing bacterium at the concentration of 1/10,000, and chlortetracycline (aureomycin) and tetracycline (achromycin) inhibited at the concentration of 1/10,000.

6.54 REMOVING FISH OIL FROM ACTIVATED CARBON

Van der Merwe, R. P.
Annual Report, Fishing Industry Research Institute, April-December 1956, Cape Town, South Africa, 10, 37-38 (1957)

In the production of fish flour, activated carbon is used for the final purification of the solvent after it has been passed through the still. If the still is overfilled, a carry-over of solvent into the carbon-packed column may occur. This results in fat being carried over onto the carbon in the column. The fat content of the carbon was reduced experimentally to about 0.7 percent when the carbon received four extractions of 20 minutes each with three weights of solvent in a flask under a reflux and with stirring.

6.54 FEED FROM WASTE FISH AND STARCH RESIDUE

Tomiyasu, Yukio and Sekiya, Yoshiharu (to Great Asia Scientific Research Co.)
Japan 9372 (Nov. 7, 1957)
Chemical Abstracts 52, 14027 (August 25, 1958)

Starch residue (120 kg.) containing 50 percent H_2O and 4.5 kg. $CaCO_3$ is mixed with 0.6 kg. bran, 1.2 kg. superphosphate, and 5 kg. of the liquid portion from cooking 100 kg. waste fish. The mixture is steamed for 1 hour and vitamin B_1 and B_{12} are added at 35°. The mixture is inoculated with Aspergillus, fermented for 48 hours at 28°, and mixed with the solid portion of cooked fish waste, 300 kg. starch residue, 150 kg. bran, 150 kg. Aspergillus, and 150 kg. yeast culture. It is then fermented for 48 hours at 30° to 60° and the product is dried in vacuo at 57°.

7.81 ON THE DETERMINATION OF TRIMETHYLAMINE AND TRIMETHYLAMINE OXIDE. A MODIFICATION OF THE DYER METHOD

Hashimoto, Yoshiro and Okaichi, Tomotoshi (Faculty of Agriculture, Tokyo University)
Bulletin of the Japanese Society of Scientific Fisheries 23, No. 5, 269-272 (1957) (English abstract, figures, and tables)

The extraction of trimethylamine (TMA) with toluene was found to be affected by temperature, kinds of alkali, and amount of shaking, whereas the color development of TMA with picric acid was not influenced by temperature. As a result the extraction was made at 30° C. and with a 25-percent potassium hydroxide solution instead of a 50-percent potassium carbonate solution. These modifications gave 97 percent recovery of trimethylamine oxide and the recovery of as little as 0.025 mg. N.

7.81 DETERMINATION METHOD OF FRESHNESS OF FISH MUSCLE WITH TRIMETHYLAMINE

Horie, Susumu and Sekine, Yutaka (Tokyo Univ. Fisheries, Kurihama)
J. Tokyo Univ. Fisheries 42, 25-31 (1956)
Chemical Abstracts 52, 20748g (November 25, 1958)

Trimethylamine N (TMA N) was determined in fish muscle at various stages of spoilage, as a useful criterion of freshness. Since TMA N content was very low (<1 mg. percent) in fresh fish muscle, and suddenly increased (>10 mg. percent) with onset of bacterial putrefaction, TMA content was considered a reliable method in determining freshness of fish.

8.51 SPERM WHALE MYOGLOBIN: COMPOSITION AND DEGRADATION WITH TRYPSIN

Edmundson, A. B. and Hirs, C. H. W. (Rockefeller Inst., New York and Brookhaven Nat. Lab., Upton, New York)
Federation Proceedings 18, Part I, 220 (March 1959)

Crystalline sperm whale myoglobin was chromatographed on XE-64 resin by the method of Boardman and Partridge as modified by Bodo. Four and possibly five chemically distinct components were obtained. The main component, myoglobin IV, comprised approximately 65 percent of the heme-containing proteins.

8.51 A COMPARISON OF SOME PROPERTIES OF BEEF, SHEEP AND WHALE THYROTROPINS

Pierce, J. G.; Wynston, L. K.; and Free, C. A. (Dept. of Physiological Chemistry, University of California Medical Center, Los Angeles)
Federation Proceedings 18, Part I, 302 (March 1959)

Thyrotropic activity has been concentrated from sheep and whale pituitaries as well as from bovine glands by an extraction procedure followed by chromatography on DEAE-cellulose (Pierce, Wynston, and Carsten, Biochim. Biophys. Acta 28:434, 1958; Condliffe and Bates, Arch. Biochem. Biophys. 68:229, 1957). An investigation by a microelectrodialysis technique of the behavior of the sheep and whale material on starch gels has shown that the biological activity is retained behind membranes that also retain beef preparations (Pierce and Carsten, J. Am. Chem. Soc. 80:3482, 1958).

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8.53 FATNESS OF SMALL HERRING IN THE BAY OF FUNDY

Leim, A. H. (Fisheries Research Board of Canada, Biological Station, St. Andrews, New Brunswick)
Journal of the Fisheries Research Board of Canada 15, 1259-1267 (November 1958)

Fat determinations, by ether extraction, were made on 205 samples of herring (Clupea harengus) from the Quoddy region of the Bay of Fundy on the east coast of Canada from 1942 to 1952. Fat was lowest from April to June and highest from August to November and varied between 1.2 percent and 27.5 percent of the wet weight of the fish. There was marked variation from year to year. Until sexual maturity was reached, fatness increased with size. Certain regions are noted for very high fatness. A fungus disease did not greatly affect the fatness of recovering fish.

8.53 THE CONTENT OF FAT AND FAT-FREE DRY MATTER IN WINTER HERRING DURING THE YEARS 1930-1956

Flood, Einar
Fiskeridirektorat. Skrifter, Ser. Teknol. Undersøk. 3, No. 5, 1-9 (1958)
Chemical Abstracts 53, 5534f (March 25, 1959)

Data on the content of fat and fat-free dry material of the Norwegian winter herring are given, based upon industrial analyses of a great number of catches during the years 1930 to 1956. The fat of winter herring varies considerably year by year and diminishes during the catching season, the average figures declining from 12.5 to 9.6 percent. On the other hand the fat-free dry material is a figure of more constant value, showing a small seasonal decline, 19.9 to 19.1 percent on the average.

8.64 CHOLINE CONTENT OF THE MUSCLE OF AQUATIC ANIMALS

Mori, Takajiro; Konosu, Shoji; and Miyagawa, Shoji
Bulletin of the Japanese Society of Scientific Fisheries 23, No. 5, 282-284 (1957) (English abstract, tables, and figures)

Ordinary muscle revealed a level of total choline, ranging between 0.4 and 0.6 mg. per gram on a wet basis. The level of choline was two to three times higher in the red muscle of yellow tail and in the deep-seated red muscle of big eye. Squid muscle showed a rather high value of total choline, whereas the octopus muscle was nearly the same as the ordinary muscle of fish. Free choline was very low in the muscles tested, with the exception of fresh clam and stored squid in the frozen state.

8.64 MARINE PLANTS AND SAPROPELS AS SOURCES FOR VITAMIN B_{12}

Kutseva, L. S. and Bukin, V. N.
Proc. Acad. Sci. U.S.S.R. Biochem. Sect. 115, 195-7 (1957) (English translation)
Chemical Abstracts 52, 12324 (July 25, 1958)

See C. A. 52, 4107b.

9.2 AN ECONOMIC ANALYSIS OF FREEZING FISH AT SEA

Rosen, Sumner M.
Commercial Fisheries Review 20, 1-14 (November 1958)

(Abstract of this article appears under 2.118 page 3 - April 1959)

9.2 CANNED FISH RETAIL PRICES

Anonymous
Fishery Leaflet 476a, 24 pp. (1958) (U. S. Department of the Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, Washington 25, D. C.)

9.4 DIRECTORY OF FISHERY PRODUCTS AND COMPANIES

Anonymous
Canadian Fisheries Annual 1958, pp. 89, 90 (1958) (Gardenvale, Quebec)

9.4 GEOGRAPHICAL LISTING OF FROZEN FISH AND SEAFOOD PACKERS

Anonymous
Frosted Food Field 28, 18, 21 (April 1959)

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